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Criteria and Methodology for Examination of Analysis Agencies for Manufactured Building

One and Two Family Dwelling Systems and Components

J. O. Bryson, J. L. Heldenbrand, B. M. Vogel

Project LEAP
(Laboratory Evaluation and Accreditation Program)
Center for Building Technology
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National Bureau of Standards
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April 1973

Preliminary Report

Prepared for
National Conference of States on Building Codes and Standards

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This report is to be superseded by a future publication which will receive general distribution and should be cited as a reference. Please consult the NBS Office of Technical Information and Publications to obtain the paper citation.

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U. S. DEPARTMENT OF COMMERCE, Frederick B. Dent, Secretary
NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, Director

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ABSTRACT

Criteria are proposed by which participating institutions may be judged for their capability to perform the Analysis function in the evaluation and regulation of manufactured one and two-family dwellings and components, including mobile homes. Procedures are also proposed for use by an examining agency in determining if the criteria are met. The criteria and methodology are intended as guidelines for objective examination of applicant public or private institutions who desire to serve as designees of state government in the analysis of documents describing a given manufactured building system or component. Based on a study of the state-of-the-art and current model enabling legislation, a comprehensive description of the required Analysis function services is provided as a basis for proposing a level of the criteria acceptable to the states. Appendices describe proposed institutional mechanisms and provide supporting information and forms. Implementation of the proposed criteria and methodology, through the standards making work of the ASTM E-32 Committee, is intended to provide the states with a basis for informal reciprocity of institutional accreditations and of building-evaluation findings.

PART 1 INTRODUCTION

CONTENTS

1.1 GENERAL

Building technology is changing rapidly; one manifestation of this is the increased industrialized production of a wide range of complex construction components and assemblies. Factory produced building systems often involve innovative processes not specifically described in the applicable building code and for which traditional field experience provides little guidance for the building official. Moreover, they may also be fabricated beyond the legal jurisdiction of the installation site. As a result, the local building official's technical evaluation of manufactured buildings for code compliance may be difficult, and may entail trips to distant factories for prototype examination and periodic production line inspections.

The National Conference of States on Building Codes and Standards (NCSBCS), formed in 1967 to consider problems of building regulation, has suggested that the states may utilize the services and facilities of qualified public or private institutions to provide building analyses, testing and inspections. To aid the several states in implementing such a process, a Department of Commerce Special Working Group[1] developed model legislation under the title of Model Manufactured Building Act and the related (but separate) Rules and Regulations.

[1]DOC Special Working Group No. 1 was composed of representatives from National Conference of States on Building Codes and Standards, National Association of Building Manufacturers, Building Officials and Code Administrators International, Inc., International Conference of Building Officials, Southern Building Code Congress, U.S. Department of Commerce, and U.S. Department of Housing and Urban Development.

To establish an appropriate degree of intra- and interstate credibility regarding building system evaluations made through use of either public or private institutions, the states may wish to utilize an accreditation program for such institutions. For the purpose of accreditation, the National Bureau of Standards (NBS), was asked to develop criteria by which participating institutions may be judged for their capability to perform identified building-evaluation functions, and procedures for an examining agency to use in determining if the criteria are met. To this end, NBS has instituted a research project identified as the Laboratory Evaluation and Accreditation Program (LEAP). The American Society for Testing and Materials (ASTM) has been asked to develop consensus standards for examining such institutions, based on the Project LEAP documents.

For accreditation purposes, Project LEAP has divided the building-evaluation services that may be performed by accredited agencies into three distinct functions; analysis, testing and compliance assurance. These functional terms are defined below. Additionally, for the purposes of this report, the term Agency designates the accredited or approved status of a public or private institution to act as an agent of the state in the regulation of manufactured building. (e.g. Analysis Agency performs the Analysis function.)

(1) Analysis is the building-evaluation process which includes analytical examination and review of design and test documents using professional judgment and experience, to determine whether a proposed manufactured building or component conforms to applicable codes and standards.

The Analysis function is the same as the Evaluation function defined in the Model Manufactured Building Act, and has also been referred to by others as Engineering Analysis and Systems Analysis.

(2) Testing is the building-evaluation process whereby the engineering properties claimed for manufactured buildings or components are validated by using appropriate standard test methods or other approved physical simulations based on recognized engineering principles.

(3) Compliance Assurance is the building-evaluation process of appraising the manufacturer's compliance control program, in conjunction with full-time or periodic monitoring, surveillance or audit, implemented to provide objective evidence that manufactured buildings or components conform to the approved design drawings and specifications.

Compliance Assurance relates to the Inspection Agency function as defined in the Model Manufactured Building Act, and has also been variously referred to as Quality Analysis and Quality Control. The Compliance Assurance Manual is prepared and the program implemented by the Compliance Assurance function and approved by the Analysis function under the Model Manufactured Building Act.

Compliance Control Program is the manufacturer's system, including directly related quality and process controls, for assuring

compliance with applicable codes and standards. The Compliance Control Document is prepared and the program implemented by the manufacturer and approved by the Compliance Assurance function. The Compliance Control Document is incorporated into the Compliance Assurance Manual.

For justification and description of the proposed two-part Compliance Control/Compliance Assurance approach, see Sections 2.3, 2.3.4, 2.4.7 and Attachment B.

This report related primarily to the first of the three functions--Analysis. The report is compatible with and an extension of the earlier LEAP documents on the Testing function and is largely based on a study performed for NBS by B. A. Berkus Associates. The report is presented in four parts:

1. Introduction
2. Analysis Function
3. Requirements, Criteria and Methodology for Examining the Analysis Function
4. Identification of Concerns and Issues

Part 1 serves as an introduction and provides an executive summary of the document.

Part 2 identifies the tasks and procedures performed by the model Analysis function. In approaching this study, it was necessary to establish the criteria for the Analysis function in relationship to the expected services to be performed, as identified by a study of the state-of-the-art and by the Model Manufactured Building Act and related Rules and Regulations. Therefore,

a comprehensive description of the services to be rendered by a model Analysis Agency is included in this section as a basis for defining an acceptable level of criteria and the attendant methodology for examination.

Based on the requirements stemming from the identified tasks or procedures, Part 3 details the criteria and methodology for examining applicants proposing to serve as Analysis Agencies. Part 4 lists concerns and issues related to the regulation of manufactured building which have been brought into focus by this study.

Appendices are included which describe proposed institutional mechanisms and provide supporting information, forms and a glossary of terms. In particular, Appendix A suggests possible procedures for states to use in monitoring and auditing the buidling-evaluation process (see asterisks on Attachment B). A proposed institutional mechanism for accreditations and for reciprocity of building evaluations is presented in outline in Appendix B, "This Is LEAP."

1.2 DESCRIPTION OF STUDY APPROACH

In order to develop criteria and methodology for determining the capability of an organization to carry out any activity, that activity itself must first be analyzed and understood. From such an understanding, it becomes possible to derive the organization's necessary characteristics. This observation led to the development of a study approach consisting of three parts:

(1) A study of current analysis function activities.

(2) Establishment of a model procedure for the Analysis function.

(3) Development of appropriate criteria and methodology for examining institutions that desire to undertake the Analysis Function.

1.2.1 STUDY OF CURRENT ANALYSIS FUNCTION ACTIVITIES

The study of current Analysis function activities had two separate phases. The first was a detailed examination of the One and Two Family Dwelling Code[2] and American National Standards Institute Standard ANSI A119.1 - 1972, Standard for Mobile Homes.

The second consisted of informal interviews conducted by B. A. Berkus Associates, consultants to Project LEAP, with a selection of code enforcement agencies, building manufacturers and building professionals from across

[2]The One and Two Family Dwelling Code was jointly developed by the American Insurance Association, Building Officials and Code Administrators International, Inc. (BOCA) International Conference of Building Officials (ICBO), and the Southern Building Code Congress (SBCC).

the nation. These interviews gathered experience and points of view related to documents, personnel, organizations and procedures currently used or encountered in the Analysis function.

Both phases of the study of current Analysis functions and activities distinguished between conventional building and industrialized building for the purpose of isolating the particular requirements imposed by the industrialized building process.

The first phase of the study of current Analysis functions concluded that both of the codes studied were of limited use in the establishment of model procedures for the Analysis function for industrialized housing.

The One and Two Family Dwelling Code was found too prescriptive in nature, confined to a limited range of building construction and thus providing no guidelines for evaluation procedures for any kind of innovative industrialized housing. This point is discussed more fully in PART 2 Analysis Function.

The ANSI A119.1 - 1972, Standard for Mobile Homes, while confined to a very limited range of building types, was found to recognize the need for a performance base by establishing a range of performance objectives to be met by any system. It, too, however, was found to be of limited use in establishing the model procedure, as is discussed in PART 2 Analysis Function.

The second phase of the study of current Analysis functions, the informal interviews, served primarily to call attention to issues and concerns of current building process participants and building regulation personnel when considering the regulation of industrialized building. While in no way

exhaustive, the following is a partial list of typical concerns:

(1) Local conditions, and especially problems of safety during construction, must still be regulated when state codes preempt local codes. These areas must still be regulated.

(2) Current building evaluation and approval procedures are generally reactive, and an applicant cannot often anticipate what will be required of him.

(3) Current procedures are not efficient in accommodating technological innovation.

(4) Legal liability in the regulation of building is unclear.

(5) Third-party monitoring of compliance with regulations is desirable and necessary.

(6) Building regulation must be viewed as an integral part of the building process, rather than as a law enforcement activity.

The appendix contains a list of organizations interviewed. Copies of the questionnaire are also included.

1.2.2 ESTABLISHMENT OF MODEL PROCEDURE

The establishment of a model procedure for the Analysis function resulted from a series of meetings in which comments from the interviews were reviewed. These comments detailed the current state-of-the-art of the building-evaluation process and further pointed out the problems and difficulties faced by the producer desiring approval. Incorporating these findings, a model procedure meeting four general goals was devised. These

four goals are:

(1) Develop a procedure which is anticipatory rather than reactive. Thus, an applicant should have a reasonably clear idea of what is expected of him when he initiates an application for approval.

(2) Develop a procedure which is capable of processing applications for products at any level of preassembly. Thus, an application for a panel or assembly, and an application for a three-dimensional module or entire house, should be handled by the same documentation and processing formats.

(3) Develop a procedure which is capable of processing applications submitted by a variety of building process participants.

(4) Develop a procedure which is capable of processing applications for approval of products involving innovative materials and/or assemblies which are not prescribed or approved under current building codes, as well as serving the needs of conventional building manufacturing processes.

The proposed model procedure is fully described in PART 2 Analysis Function. Its main features can be summarized as follows:

(1) Organizing the Analysis function as a project-oriented, inter-disciplinary team effort, managed by a project leader (manager) from start to finish.

(2) Instituting a preliminary meeting of the Analysis Agency project leader and the applicant, to determine the scope of the product and process involved in the submission in question.

(3) Drafting a Control Document at the preliminary meeting, to guide the subsequent analysis and approval process. This document consists

of a control matrix (see Attachment A for one possible format) describing the product and its code-required attributes, and a management plan describing the applicant's role in the proposed process.

(4) Requiring the formal submission of three documents: 1) a Product Description Document, consisting of plans, calculations, specifications, tests reports, etc.; 2) a Compliance Assurance Manual, consisting of the manufacturer's Compliance Control Document and documentation of the Compliance Assurance Agency's program; and 3) an Installation Document, consisting of the site installation drawings and instructions, etc. These may be submitted all at the same time, or separately, and the model Analysis function is designed to respond accordingly.

(5) Requiring inclusion of a proposed performance specification as a part of the Product Description Document for innovative products not prescribed by the applicable codes.

In addition to identifying each step in the Analysis function the proposed model procedures indicate the Analysis Agency's relationship to two other functions: Testing and Compliance Assurance. The Testing Agency provides the Analysis Agency with data upon which specific evaluation can be made. The Compliance Assurance Agency implements the monitoring inspection procedures described in the Compliance Assurance Manual.

1.2.3 DEVELOPMENT OF REQUIREMENTS, CRITERIA, AND METHODOLOGY

Finally, the development of appropriate criteria and methodology proceeded from a detailed analysis of the proposed Analysis function procedures as they would apply to one and two family housing. Specifically, each of the three submittal documents were examined in terms of the traditional disciplines and areas of code requirements:

(1) Structural

(2) Mechanical

(3) Electrical

(4) Plumbing

(5) Architectural - Health and Safety

(6) Fire Safety

It should be noted here that while a pure application of the performance concept would identify categories of code-regulated building attributes, such as serviceability, health and safety, maintainability, etc., and would apply them across the hardware categories of plumbing, mechanical systems, structures, etc., the categorization proposed here is more realistic in light of the state-of-the-art which mixes disciplines by hardware category with disciplines by attribute category, and will probably be followed in the staffing of an Analysis Agency. For the purposes of this study, the above six categories will be referred to as the "building system disciplines."

In each area, the specific items to be analyzed were identified. From an understanding of the specific requirements, it became possible to develop the criteria and methodology for examining the personnel charged with carrying out each activity.

Additionally, criteria and methodology were developed for the management of the Analysis Agency, for its coordination with the Testing and Compliance Assurance Agencies and for the monitoring of the system.

1.3 STUDY LIMITATIONS

It is necessary here to state the limitations of this study. These relate to two areas: limitations due to resources (time and budget), and limitations due to scope of building types.

(1) Resources: While the study of current analysis functions involved the analysis of several current codes in-depth, as well as the interviews with the model code groups, testing agencies, building departments, government agencies, building manufacturers, product manufacturer associations and A/E firms, this report is neither a consensus, nor a representative sample of opinions in the national building regulatory community.

This report is a statement of the opinions and judgments of the authors as informed by the interviews. The interviews served to identify problems, issues and areas of concern and as a checklist against which to test the proposed model Analysis Agency.

The questions of fee structure and conflict of interest are beyond the scope of this study.

(2) Building Types: The specific codes reviewed as part of this project were the One and Two Family Dwelling Code, and the ANSI A119.1 - 1972, Standard for Mobile Homes.

While the proposed Analysis procedures are generic to housing of all types, and in fact, to other building types as well, the procedures used to identify the requirements and to develop examination criteria and methodology were those relating specifically to one and two family dwellings. The requirements would remain essentially the same, while the criteria may change for other building types.

PART 2 ANALYSIS FUNCTION

CONTENTS

2.1 DEFINITION OF ANALYSIS FUNCTION RELATIVE TO OTHER FUNCTIONS

The Analysis function in certification of industrialized housing is one part of a coordinated set of procedures designed to regulate industrialized building activity. Like all other regulation of building, it is an exercise of the government's authority to regulate and control certain activities which affect the public's health, safety and welfare.

The regulation of industrialized building differs from the regulation of conventional building in several ways:

(1) Industrialized building is likely to involve pre-assembly of parts at a location remote from the final building site. It is also likely that such preassembly of parts could not be inspected for code compliance at the building site without their dismantling or disassembly. Traditional on-site inspection methods, used effectively in conventional building, are clearly not suitable for industrialized building and must be supplemented. This one of the impetuses for Project LEAP.

(2) Industrialized building involves the repetitive application of a limited number of designed parts in a large number of buildings. Since the building site is unlikely to be known at the time of manufacture or of design, and in order to justify the capitalization necessary for the manufacture of industrialized building, some form of design approval

independent of the specific building site necessary.

(3) Since industrialized buildings are likely to be marketed across areas that transcend the jurisdiction of any one local government, it would be uneconomical to subject them to regulation by local building codes that differ widely in both substance and form. This fact has given rise to the recent promulgation of state codes for industrialized building that preempt local building codes. For similar reasons, efforts are currently underway to develop uniform procedures that would contribute toward the goal of interstate reciprocity in the area of industrialized building.

(4) Industrialized building carries with it the potential for technological innovation in both materials and processes. It therefore requires regulatory procedures that are designed to accommodate such innovation, with due regard for the public health, safety and welfare.

Responding to these distinct characteristics, regulatory procedures for industrialized building are arranged in three function categories:

- Analysis Function
- Testing Function
- Compliance Assurance Function

The Analysis function examines the documentation submitted by an applicant as evidence that a particular product, or manufactured building, is designed in accordance with applicable codes and standards.

The Analysis function also examines the documentation submitted by an applicant demonstrating a delivery process (manufacture, transportation, erection) which is controlled and monitored in a manner assuring that each delivered product has been constructed in accordance with the approved design, and is thus in compliance with applicable codes and standards. The documentation required by the Analysis function is described in detail later. The Analysis function concludes in the granting or the withholding of approval of either or both the product's design and the plan which documents the program for assuring it's compliance with the applicable codes and standards.

The Testing function operates when, for any reason, physical tests must be performed to produce the evidence that a particular product has been designed or manufactured in accordance with applicable codes and standards, and will usually be required when other methods, such as calculation or observation, cannot provide such evidence unambiguously. This evidence then becomes part of the documentation required by the Analysis function.

The Compliance Assurance function implements monitoring procedures that are documented in the Compliance Assurance Manual and approved under the Analysis function, and assures the delivery of products conforming with the approved design, and thus conforming to applicable codes and standards. (The special question of inspection during transportation will be raised later.)

2.2 OBJECTIVES FOR THE DESIGN OF THE ANALYSIS FUNCTION

The Analysis function is designed to meet four objectives which have emerged as paramount within the current state-of-the-art of industrialized building; these are:

(1) Anticipatory rather than reactive,

(2) Applicable to a broad range of product preassembly,

(3) Capable of processing applications submitted by a variety of building process participants, and

(4) Capable of coping with technological innovation.

Objective (1) above, responds to concerns of the often-heard criticism of current building regulatory practice as it affects the innovative or the non-routine; namely that it is a reactive system. It is not uncommon for a manufacturer to initiate an application for approval without knowing the time or effort involved. Neither is it uncommon for the evaluating agency to request additional information, additional tests, etc., late into the evaluation process. While this type of reactivity cannot be eliminated entirely, there is no logical reason why a much higher proportion of activities cannot be anticipated at the start of the total regulation process. The first objective will be achieved, or at least approached, by the preliminary meeting which is proposed as the first part of the Analysis function, and which will be discussed in detail later.

Objective (2) above, is related to the recognition that any building can be viewed as a physical hierarachy: for example: parts, components, assemblies, subsystems and total building.

It is clear that off-site fabrication, or preassembly, can and does occur at any level of this hierarchy. The actual level at which it occurs is a function of the system's design, of the materials used, and of other technical and economic considerations. Doors, wall panels, room modules, and whole buildings are all capable of preassembly. The distinct characteristics of the regulation of industrialized building, discussed in the first part of this chapter, apply equally to any of the foregoing levels of preassembly. Yet, the substance of the documentation required by the Analysis function must clearly vary to reflect the level at which preassembly occurs for any particular case. The proposed Analysis function procedures are designed to handle applications for approval of products of a broad range of preassembly, and thus achieve this objective. Specifically, the design and use of the proposed Control Document, to be discussed in detail later, are essential to meeting this objective.

Objective (3) above, reflects the realities of current developments in the building industry and reflects concerns and issues which arose in meetings with manufacturers. While companies develop the expertise and resources to design and manufacture complete products or building systems, others concentrate on developing the management tools and controls necessary for ultimate delivery of the product; they assemble

building systems from parts designed and manufactured by a number of different companies. (This approach had been developed to an advanced state in the aerospace industry. The term "Boeing model" has been coined to describe the approach.) The clearest example of such a system is the Descon-Concordia system consisting of:

- A structural scheme employing a specific material (concrete).
- A detailed design of joints between structural members.
- A set of space layouts detailing configurations and dimensions.
- A management plan consisting of performance specifications, compliance control programs and procedures to assure appropriate assembly of a variety of possible buildings, as well as detailed design of certain elements (e.g., kitchens and baths within the "black box" shown in the space layouts, thickness of certain concrete members, etc.).

It is obvious that working drawings, compliance control and other documentation of such a system will differ from the conventional.

The idea behind such an approach is that certain parts of a building system may vary to respond to specific local market conditions (e.g., capabilities of local precasters, availability of packaged core modules etc.) without impairing the system's integrity and its response to codes

and standards. If the Descon System were used in two locations, each one may vary in some details, yet there seem to be advantages to having Descon apply for system evaluation of the "Descon System," rather than having each local developer apply for evaluation as for a separate system. The subsequent approval of undetermined details (yet whose design is strictly controlled by the "system") may be either a Compliance Assurance function, a local code function or processed as a change.

It is likely that the Descon-Concordia or Boeing model approach represents a trend in industrialized building which will grow in the future. Hence, the postulated goal that the evaluation procedure be capable of coping with this approach. The proposed model procedure responds to this goal by:

1. Requiring the development and submission of a management plan as part of the Control Document, to describe the applicant's role in the proposed process (Section .2.2).
2. Use of the management plan as input into the Compliance Assurance and Installation Documents, and thus giving the Analysis Agency the opportunity to evaluate the inter-relationships and note necessary subsequent inspections and approvals. (Section 2.3.1.2.)
3. The use of the Control Matrix to display parts of the building, how they relate, whether and how they are included in the submission. (Section 2.3.1.1.)

4. Proposing Matrix Intercept Forms which permit the recording of options, alternates and interfaces to be considered in the evaluation. (Section 2.3.1.1.)

Objective (4) above, relates to technological innovation. This is most crucial for an Analysis function designed to regulate industrialized building, since here is where industrialized building's greatest potential lies. Most current building codes are prescriptive in nature; they fully prescribe materials and details of assembly for a limited range of traditional building methods. Their provisions for handling innovative systems beyond the scope of those prescribed may be typified by the following excerpt from the One and Two Family Dwelling Code:

> Sec. R-180: The provisions of this code are not intended to prevent the use of any material or method of construction not specifically prescribed by this code, provided any such alternate has been approved.
>
> The Building Official may approve any such alternate provided he finds that the proposed design is satisfactory and complies with accepted design criteria.
>
> The Building Official may require that evidence or proof be submitted to substantiate any claims that may be made regarding its use.[1]

[1] One and Two Family Dwelling Code Under the Nationally Recognized Model Codes, 1971 Edition. Basic Building Code, Building Officials and Code Administrators, International, Inc.; National Building Code, American Insurance Association; Southern Standard Building Code, Southern Building Code Congress; Uniform Building Code, International Conference of Building Officials. Page 4

Beyond the reference to "accepted design criteria," or something similar, most codes do not provide the building official with any instruments to assist him in discharging this responsibility for approval of alternates.

ANSI A119.1 - 1972, Standard for Mobile Homes is often cited as an example of a code which does provide such an instrument:

> 1.4...An enforcement agency may approve any such alternative if it finds the proposed design is satisfactory for the purpose intended, and...is...at least the equivalent performance of that prescribed in this standard considering quality, strength, effectiveness, durability, safety, and protection of life and health....[2]

This goes beyond the One and Two Family Dwelling Code in that it specifies the "purpose intended" and provides the building official six areas of performance where equivalency must be established. The ANSI A119.1 - 1972 proceeds to enunciate basic prinicples at the start of at least two of its major subdivisions (Body and Frame Design and Construction, Plumbing, Heating, Electrical). These basic principles may be viewed as performance goals, directly related to, and derived from, the six areas of performance mentioned above. The Standard then lists specific requirements. However, neither the derivation of specific

[2]ANSI A119.1 - 1972, Standard for Mobile Homes. Sponsored by: Mobile Homes Manufacturers' Association, National Fire Protection Association, Trailer Coach Association. Page 11.

requirements from the performance goals, nor the derivation of the latter from the six areas of performance, is made explicit in any way. Moreover, ANSI A119 - 1972 permits the manufacturer to propose tests that may prove the equivalency of performance, but without providing the building official with any guidelines for evaluating acceptability of those tests. The proposed Analysis function procedure responds to the fourth objective by requiring the submission of a proposed performance specification with and application for approval of any innovative system or part. This submission, and its evaluation as part of the Analysis function, together will make explicit the links between performance objective, particular requirements and test methods, thereby providing usable instruments for the evaluation of technological innovations.

2.3 DOCUMENTS OF THE ANALYSIS FUNCTION

The documentation required by the Analysis function can be grouped into four basic items:

(1) Control Document

(2) Product Description Document

(3) Compliance Assurance Manual

(4) Installation Document.

The first of these is prepared by the applicant and the Analysis Agency jointly and serves to control the processing of the other three. The second and fourth documents are prepared by the applicant and submitted for processing through the Analysis function.

The third document is developed as follows: Under the currently proposed Model Rules and Regulations For The Model Manufactured Building Act, the applicant is responsible for documenting the program for controlling product compliance and the Administrative Agency or Analysis (i.e., evaluation) Agency is responsible for approving the program. It is suggested here that an intermediate step be introduced as illustrated by the dashed lines in Attachment B.

Using the suggested approach, the manufacturer's compliance control program is submitted in the form of a Compliance Document, for detailed review by the Compliance Assurance function.[3] This

[3]See, Appendix G Glossary for a proposed definition of the Compliance Assurance Function.

document then forms the basis for preparation of, and is incorporated into the Compliance Assurance Manual by the Compliance Assurance function. The Compliance Assurance Agency adds it's proposed regulatory compliance assurance program to the manufacturer's compliance control program to form a single integrated document which is submitted to the Administrative Agency or Analysis Agency for approval. Advantages of this two-step approach include:

(1) The Compliance Assurance function is brought into the program at a time when it can make an effective contribution.

(2) The integrated Manual provides the Analysis function with a more effective basis for estimating the effectiveness of the Compliance Assurance Program and for evaluating key inspection check points and procedures.

(3) The manufacturer and the Compliance Assurance function document only that program for which each exercises effective control.

(4) Continuity between building-evaluation functions will be enhanced, when passing from the approval to the production stage.

The intermediate step suggested above would not effectively change the Model Rules but would enhance continuity and clarify responsibilities.

2.3.1 CONTROL DOCUMENT

The Control Document delineates the scope of the product being

submitted for approval, the range of it's attributes regulated by the applicable codes and standards, and the process by which the concept is translated into a product. It is designed to preclude arbitrariness in the Analysis function and to make that function as free of surprises as possible.

The Control Document consist of two parts:

(1) A Control Matrix which describes the product and serves as a checklist. This is accompanied by forms and questionnaires.

(2) A Management Plan which describes the product's delivery process.

2.3.1.1 The Control Matrix (See Attachment A):

The Control Matrix is a generic model of a building and its attributes, reflecting the hierarchy of building elements. It enables one to discuss attributes of elements at each level of the aggregation, while retaining the hierarchial relationship. One possible form of the Control Matrix is suggested in Attachment A. The horizontal axis of the Control Matrix is the hierarchical description of the building. It provides a graphic means for displaying the functional scope of the product proposed; by deleting those building parts not included in the application. At the same time, the relationship of the proposed product to the total building can be kept in mind and referred to when necessary. The degree of

detail to which the vertical axis is carried is purely a matter of convenience - there is clearly no logical limit.

The vertical axis of the Control Matrix lists the regulatory requirements for the building. These can include all the attributes or they can be limited to those attributes regulated by a particular code. Again, it is a matter of convenience as to how far one needs to carry the detail. (It should be kept in mind that while certain attributes, such as acoustics, are not regulated by most current building codes, the scope of public environmental concerns is rapidly expanding, and that such exclusions cannot be considered permanent.)

The Control Matrix intercepts of building elements and attributes could also be indexed to special forms, called Matrix Intercept Forms, which contain a variety of information such as the following:

(1) Code requirements and criteria.

(2) Name and type of document indicating the product's compliance with the requirements (drawing, specification, calculation, test report, sample, etc.) including indexed references.

(3) Indication if the requirement is site-specific and/or climate-specific, and if so, the specific load conditions or phenomena to which it applies.

(4) Indication if the particular product or element proposed is subject to an option or alternate of any kind (for the user, the builder, etc.), and if so, the conditions and ramifications of choosing them.

(5) Indication if the particular attribute or element imposes any special interface conditions on other parts of the building (which in turn may or may not be included in the scope of the applicant's product.)

The Matrix Intercept Forms may eventually also include the specific conclusions of the Analysis function, e.g., compliance or non-compliance, degree of compliance or actual performance level, notes to various inspectors, etc. Thus, the Control Matrix and its accompanying forms indicate the scope of the proposed product, the scope of the necessary evaluation within the Analysis function, and those building elements which remain to be approved at the local level.

2.3.1.2 The Management Plan

In addition to the Control Matrix, the Control Document includes a Management Plan that describes the applicant's proposed process from raw materials acquisition to occupancy and use of the finished product or building. It precisely defines the applicant's role in each step of the proposed process, distinguishing between steps performed by him directly, and those performed by others under his direct or indirect control. The Management Plan thus provides direct input into the Compliance Assurance Document and the Installation Document discussed below. It also draws attention to two aspects of building which are regulated by current building codes and which may not appear as explicit items on the Control Matrix:

(1) Safety during erection/installation.

(2) Control of pollution or other unwanted output resulting from the building or product in use.

2.3.2 Performance Specifications

As mentioned above, it is proposed that an applicant be required to submit performance specifications for those products or part of products not prescribed by the applicable codes and standards whose design and construction process does not follow the traditional. In most cases, this would apply to products using innovative materials, assemblies, configurations or processes. The need to submit performance specifications is determined at the preliminary meeting discussed in detail later and is recorded on the Control Matrix Intercept Forms, by identifying proposed building elements not prescribed by the codes. Clearly, performance specifications may be required for an entire submission, or for specific portions of an otherwise conventional submission.

The performance specifications should follow the format proposed in the Construction Specification Institute (CSI) Manual of Practice, MP-2D, May, 1972, "Organization and Format for Performance Specifying." This format employs four types of statements:

- Requirement Statements
- Criteria Statements
- Tests Statements
- Commentary.

The commentary should cover the following points:

(1) The relationship of the proposed requirement to the particular attribute regulated by the code.

(2) Support for the proposed criteria carrying out the code's intent.

(3) Support for the proposed test's validity and reliability in simulating the conditions regulated.

(4) Reference to subsequent documents where verification evidence may be found.

These performance specifications provide the Analysis function with an instrument that bridges the gap between the intent of the code (or its explicit performance goals, if stated, as in the case of ANSI A119.1 - 1972) and unambiguous criteria for approval or rejection. While it may be argued that such an instrument should be developed by an agency in the public service such as the Analysis Agency, there are technical, administrative and historical reasons for requesting the applicants to do so. The Analysis Agency is still charged with evaluating and accepting the proposed performance specifications. Thus, the performance specifications developed by applicants become as valid as those that would be developed by the Analysis Agency.

2.3.3 Product Description Document

The Product Description Document is a complete description of the proposed product demonstrating its compliance with the applicable

codes and standards, and/or with the proposed performance specifications discussed above. It is prepared by the applicant in accordance with the scope and guidelines noted in the Control Document, and is submitted for evaluation and approval through the Analysis function.

The Product Description Document consists primarily of the traditional building design documents, which fall into two categories:

(1) Descriptive documents

- drawings
- schedules
- specifications
- samples.

(2) Verification or support documents

- calculations
- test reports
- standards and references.

In addition to these traditional design documents, the Product Description Document may include an operation profile. This would be required if the product involved any kind of operation, and if the applicable codes and standards regulated fuel consumption and pollution. It may very well be that such an operation profile would ultimately become a general environmental impact statement (general, rather than site-specific). In the least, it would be an energy input/output analysis.

2.3.4 Compliance Assurance Manual[4]

The Compliance Assurance Manual, prepared in two-parts by the applicant and the Compliance Assurance Agency, is a complete description of all the procedures that must be followed to assure that the product delivered to a building site will be indentical to the product described in the Product Description Document and approved in the Analysis function. When combined with the procedures described in the Installation Document below, the product's final installation in a building will be assured to comply with the applicable codes and standards. When approved, the Compliance Assurance Manual forms the basis for a compliance assurance program, implemented by a Compliance Assurance Agency, and culminating in the affixing of a label to each individual product.

The compliance control procedures described in this document relate to each step of the delivery process. Thus, the question of which steps, as described in the Control Document, are to be carried out by others, is clearly germane. The specific process steps covered are the following:

(1) Material supply - Measures and procedures necessary to the integrity and performance level of the supply of raw

[4]For a more detailed discussion of the Compliance Assurance Manual and the Compliance Control Document, see "Criteria For Compliance Assurance Agencies For Manufactured Building, One and Two Family Dwelling Systems and Components," Project LEAP, April 1973.

materials and components necessary for the fabrication of the proposed product.

(2) Material storage and handling - Measures and procedures necessary to assure the integrity of raw materials and components during their in-plant handling and storage.

(3) Fabrication/assembly - Measures and procedures necessary to maintain the integrity of materials and components through the fabrication/assembly process, and to assure that the fabrication/assembled product is in accordance with the approved drawings and specifications.

(4) Product storage and handling - Measures and procedures necessary to maintain the integrity of the product through its handling and storage prior to shipment.

(5) Product transportation - Measures and procedures necessary to assure the proposed product's integrity throughout its transportation to the building site.

(6) Construction - Measures and procedures necessary to investigate faults reported by a local inspector as being beyond local remedial action.

The manufacturer's Compliance Control Document includes the following:

(1) Detailed layouts of the various manufacturing phases within the manufacturing facility.

(2) Shop drawings and specifications for the product.

(3) Manufacturer's inspection manuals, including a rationale for the frequency of sampling for the various levels of inspection.

(4) Forms for reporting, managing and monitoring the inspection procedures.

2.3.5 Installation Document

The Installation Document is a complete description of the procedures that must be followed on the building site with regard to the approved product's erection or installation in an otherwise approved building, to assure that the completed building or the erection of a complete building will conform to the applicable codes and standards. These procedures follow sequentially those covered by the Compliance Assurance Document as discussed above. The division between the two documents reflects the physical distinction between central manufacturing procedures and construction site procedures, and the jurisdictional distinction between attributes regulated by a state code and those regulated by a local building code.

Since the approved product, as described by the Control Matrix, may be somewhat less than the total building or even a complete subsystem, the Installation Document is not a complete manual for the building inspector. It does, however, provide him with all that he needs to know and all that he needs to inspect to assure interfaces and site-specific attributes.

The specific process steps covered by the Installation Document are the following:

(1) Product storage and handling on-site - Measures and procedures necessary to maintain the product's integrity through its handling and storage on the site prior to erection/installation.

(2) Erection/installation - Measures and procedures necessary to maintain the integrity of the product and its regulated attributes through the erection/installation process.

(3) Field testing - Measures and procedures required by the applicable codes and standards relative to field testing of the installed product.

The Installation Document includes the following:

(1) Product installation drawings and specifications.

(2) Inspection manuals, including the rational sequencing of inspection and construction procedures.

(3) Forms for reporting, managing and monitoring the inspection procedure.

2.4 STEPS OF THE ANALYSIS FUNCTION (see Attachment B)

The Analysis function should flow smoothly and fit into the overall building process, the industrialized building process in particular, in such a way as to impose a minimal constraint on its participants in terms of both time and expense. In order to do this, the Analysis function may be viewed as a mirror image of the design and development process - a process with which extensive experience exists.

This experience indicated that the most suitable organization for the design and development process, in areas as complex as industrialized building, is one that replaces the traditional horizontal structuring by design discipline (architecture, structure, mechanical, plumbing, electrical, etc.) with a vertical structuring by project. This type of project management involves the assembling of a project team consisting of all the disciplines required to solve the problems raised by the particular project manager who acts as the team leader.

It is suggested that the above principles of project management should be employed in the Analysis function, and that a project manager be appointed for each application received. It is the project manager's responsibility to coordinate the entire process of the Analysis function relative to the particular application. With the benefit of recommendations by his lead engineers, the project manager selects the evaluation team, and the applicant throughout the Analysis function process.

The project manager, as the team leader, must have a detailed understanding of the applicable codes and standards and of building in general as both a product and a process (see Section 3.4).

2.4.1 Preliminary Meeting

The Analysis function project manager's first task in the proposed procedure is convening the preliminary meeting with the applicant.

The proposed preliminary meeting precedes and formal submission of documents. It has several purposes:

(1) To introduce the applicant to the Analysis function project manager assigned to process his application.

(2) To acquaint the Analysis function project manager and lead engineers with scope and nature of the specific application.

(3) To acquaint the applicant with the specific code-regulated attributes of his proposed product.

(4) To establish the scope of the subsequent evaluation procedure for each building system discipline.

(5) To draw up the Control Documents discussed earlier.

The preliminary meeting is the primary instrument in achieving the Analysis function objective of becoming an anticipatory rather than a reactive process. It brings together the two principle parties to the Analysis function - the applicant and the evaluator. The applicant knows and controls the scope and details of the product he is proposing to submit for evaluation and approval, as well as the process

proposed for delivering the product to the marketplace. The evaluator knows the scope and details of the codes and standards applicable to the proposed product, and he controls the execution of the evaluation procedures required by the codes and standards. Together they can determine the required scope of the documents to be submitted and of the subsequent evaluation procedures, so that these do not come as a surprise at a later date.

The scope of both submission and evaluation are shown in the various parts of the Control Document as described above. This document could be completed in a schematic form as the preliminary meeting progresses. It could then be completed in detail by the applicant, by the Analysis Agency or by both.

At the conclusion of the preliminary meeting, the applicant is in a position to prepare his Product Description Document, Compliance Control Document[5] and Installation Document for submission as applicable.

After the preliminary meeting with the applicant and again after the submittal of documents, the project manager will review the scope of submittal with the lead engineers for each technical discipline in order to determine the technical resources needed and the schedule for performing the actual analyses.

2.4.2 Submission Of Documents

The three documents that must be submitted to the Analysis function for approval have been discussed earlier. They consist of the Product

[5]See "Evaluation of Compliance Assurance Manual", paragraph 2.4.7.

Description Document, the Compliance Assurance Manual and the Installation Document.

These documents do not all have to be submitted at the same time. It is conceivable that an applicant may want to obtain design approval on a proposed product prior to determining details of its production and delivery systems. There may be good economic reasons for such an approval, and this would require the initial submission of the Product Description Document only. Such a design approval would not be sufficient for the marketing of the product, and to be so it would have to be followed with the submission and approval of the other two documents at a later date.

At the time of the submission, the Control Document is attached to the other documents and follows them throughout the Analysis function. Also, at this time, the appropriate fee (which may depend, as discussed later, on the number of documents submitted on the scope of the product as shown on the Control Matrix and on whether the product is innovative or traditional) is collected from the applicant. The submission and fee collection are both officially noted.

2.4.3 Staffing

The suggested staffing procedure is intended to lend the flexibility which is essential to efficient performance of the Analysis function, while assuring that engineering judgment enters into the definition of scope of effort.

Immediately following the submission of documents (or, in some cases, possibly even proceeding it) the Analysis function project manager with the recommendation of the lead engineers, staffs the team that will actually evaluate the submission. The method used for staffing should employ the specific talents and unique experiences of individuals as well as the minimum criteria proposed in Part 3.

For the Product Description Document evaluation, staffing requirements would be derived from the Control Matrix which could be made to show the building system disciplines; i.e., those involved in the product's design (architectural, structural, mechanical, electrical, plumbing), as well as the special consulting disciplines of fire safety and acoustics. Staffing here would also depend on whether or not a performance specification for innovative products must be evaluated.

For the Compliance Assurance Manual and Installation Document evaluation, staffing requirements would be derived from the preliminary meeting and the management plan portion of the Control Document, where the specific materials, manufacturing processes and installation procedures are covered.

Once the staffing requirements are determined, the project manager can assemble the team. The team may consist entirely of members of his own organization, or may be supplemented by contract personnel from a pool of approved technical staff. One person, properly qualified, may also cover several disciplines.

2.4.4 Evaluation of Prescribed Systems

The evaluation of the Product Description Document for products prescribed by the applicable codes and standards is the portion of the Analysis function closest to the "plan-checking" activity of a traditional building department. This activity involves the determination of completeness and consistency of the drawings, specifications, calculations and occasional test reports, since the code describes exactly how the product should be designed. The specific requirements here vary for each of the traditional disciplines and are spelled out in detail in Part 3.

It will suffice to state here that structural evaluation would involve the checking of calculations, as well as the applicability of specific calculations to the product as described in the drawings and specifications. Mechanical evaluation would require similar activities. Both of these would require the recognition of the correct use of site-specific and climate-specific load data.

Finally, the evaluation of prescribed systems, as well as the evaluation of every other aspect of the submission as discussed below, requires the ability to concisely and efficiently request additional information and/or changes if any part of the submission is found to be incomplete or in non-compliance. This should be done in a manner which assists the applicant in expediting the new information.

2.4.5 Evaluation Of Performance Specifications

The evaluation of proposed performance specifications involves two distinct steps:

(1) Ascertaining that the proposed requirements and criteria offered by the applicant carry out the intent of the applicable code.

(2) Verifying that the proposed tests validly and reliably establish the product's compliance with the proposed criteria.

The interpretation of the code's intent requires a generalist's understanding and approach to problems of environmental regulation and control, and familiarity with the interface between behavior and environment. It requires the ability to translate abstractions like adequacy, privacy, comfort, etc., into concrete and measurable terms. It also requires an understanding of the interaction between different parts of the building in achieving the desired attributes.

The evaluation of proposed performance tests requires expertise in two interrelated areas:

(1) The ability to simulate use conditions and phenomena to which the proposed product will be subjected. Such simulation covers the full range from mathematical analysis to physical testing, and requires that the specimen tested, and the procedures applied both are valid and reliable replications of the real use conditions.

(2) The ability to anticipate modes of failure. For innovative products, this ability is analagous to the design ability, for it must assure that every relevant mode of failure of the product has been covered by a criterion and has been adequately tested.

Together, these qualifications for evaluating performance specifications are analagous to those for a generalist designer with an analytical background.

2.4.6 Evaluation Of Innovative System

As discussed above, innovative systems whose design and construction process does not follow the traditional are evaluated for compliance with performance specifications which are submitted as part of the Product Description Document. Once the performance specification is accepted, the evaluation of innovative systems is very similar to the evaluation of prescribed systems described earlier, in that the determination of completeness, consistency and mutual applicability of drawings, specifications, calculations and test reports all are involved. Two differences might be noted:

(1) It is likely that innovative systems would rely on test reports for substantiation of compliance to a much greater extent than prescribed systems. Thus, more experience in the analysis and interpretation of test reports may be required.

(2) Innovative structural systems, or innovative materials used structurally, may require some non-traditional structural calculations as part of the evidence of compliance. The ability to check such calculations may call for an evaluator with more experience or theoretical background than otherwise.

2.4.7 Evaluation of Compliance Assurance Manual

The evaluation of the Compliance Assurance Manual is an activity which is unique to the regulation of manufactured building, since it has virtually no parallel in traditional building code enforcement. Under the Rules and Regulations for the Model Manufactured Building Act, the responsibility for approval of the Compliance Assurance Manual is given to the Administrative Agency or Analysis Agency. The agency performing this function requires expertise in three broad areas:

(1) Understanding the characteristics and attributes of the particular materials and products employed in the application under consideration.

(2) Understanding the industrialized manufacturing processes and monitoring and control procedures in general.

(3) Predicting the modes of failure of materials and products undergoing processing of various kinds, so that the measures proposed for monitoring and preventing failures can be assessed.

Evaluating the Compliance Assurance Manual also requires, in addition to the evaluation of the proposed Compliance Assurance program, an assessment that the particular applicant under consideration has in fact, the technical and managerial capabilities to implement the proposed program. As suggested in Section 2.3, it is proposed that responsibility for the detailed assessment of these managerial capabilities be borne by the Compliance Assurance Agency, in conjunction with it's review of the applicant's Compliance Control Document. Overall approval of the Compliance Assurance Manual, including the Compliance Control Document, is then the responsibility of the Analysis function. These relationships can be made visible to all concerned with the help of the management plan included in the Control Document and discussed earlier. Attachment B illustrates the submittal sequence.

2.4.8 Evaluation of Installation Document

The installation Document is intended for use by local building inspectors, and its evaluation requires the expertise in field construction experience which such inspectors should have. The fact that we are dealing with manufactured products, or manufactured buildings, adds two related points that must be covered:

(1) The problem of safety during construction may require an added dimension, or additional complication, in the case of manufactured buildings. Procedures for safety during erection are covered in the Installation Document. The evaluation of the safety procedures will require that additional expertise be obtained by the local building inspector.

(2) As in the Compliance Assurance Manual evaluation, the ability to predict the modes of failures of materials and products undergoing a process is germane to evaluation of the Installation Document. The only difference is that in this case we are talking about the field erection process, and the expertise in that process necessary to cover the proposed measures for monitoring and preventing such failures.

The evaluation of the Installation Document may require that the particular applicant, or some other party, have the technical and managerial capabilities to implement the proposed erection/installation process; the Control Document's management plan is of use for this purpose.

2.5 APPROVAL

The Analysis function procedure diagram (see Attachment B) shows the Approval activity "box" as being half-in and half-out of the heavy line area bordering the Analysis function. The reason for this graphic peculiarity is that while it is anticipated that the state could delegate the entire Analysis function, or any part of it, to an appropriate qualified private or governmental agency, there may be legal or other constraints to delegating the actual activity of approval. In such cases, an Analysis Agency might recommend approval, with the state actually granting it.

Approval can be given to any one of the three documents submitted, but only approval to all three can be viewed as a license to use the product in actual buildings.

While it is beyond the scope of this report to discuss the approval function in detail, it should suffice to list the possible uses of a formal approval:

(1) To be included in an application by a local builder for a local building permit for a proposed building using the approved product.

(2) To accompany an application by the applicant for approval of his product in another state, with which the approving state has a reciprocity agreement.

(3) To indicate approval of only one of the documents, for the applicant's further use.

Finally, if approval cannot be granted for any reason, the Analysis function should develop and document information which could be transmitted to the applicant with the notice of non-approval, so that any necessary remedial actions on his part would be facilitated. Thus, in cases of non-approval, the Analysis function itself would enhance the chances for approval at a future date.

PART 3 REQUIREMENTS, CRITERIA AND METHODOLOGY FOR EXAMINING THE ANALYSIS FUNCTION

CONTENTS

3.6.6 - FIRE SAFETY

3.6.7 - ACOUSTICS

3.7 - CRITERIA AND METHODOLOGY FOR EXAMINING TECHNICAL STAFF EVALUATING COMPLIANCE ASSURANCE MANUALS

3.8 - CRITERIA AND METHODOLOGY FOR EXAMINING TECHNICAL STAFF EVALUATING INSTALLATION DOCUMENTS

3.1 GENERAL DISCUSSION

PART II described in detail the various functions the Analysis Agency must perform in evaluating a building system or component. In this part, Analysis procedures for both management and the building-system desciplines are further broken down to identify:

Task - Procedure or element of a particular function; often implied by the related "Requirement" and thus unstated.

Requirement - Attributes such as knowledge, skill or judgment needed to perform the task.

Criteria - Standard or limits describing the minimum satisfactory embodiment of the stated requirement.

Methodology - Procedures for the examining agency to use in determining if the criteria for a building-evaluation function are met by an applicant institution.

The methodology of examining the Analysis Agency's capabilities to perform these functions requires a two-phase review. The first involves the management functions and the second involves the technical capabilities of the staff.[1]

The Analysis Agency may be a public or private organization or combination of the two. This is to be determined by the desires of the particular state. The Agency may be approved to provide services and facilities for evaluating either prescriptive or innovative manufactured building systems, or both. The Agency may be staffed fully or depend, in part, upon consultants and specialists as the need arises.

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[1]For definitions of the terms Architect, Engineer and Engineering Technican as used in this report, see Appendix G Glossary.

It is anticipated that a number of specialists may be approved independently, providing a pool of personnel for the building-system evaluation process. However, in order to qualify as an Analysis Agency, lead engineers from each of the building-system disciplines must be either on the staff or under contract for the purposes of providing engineering judgment during the preliminary screening process. Engineering judgment is necessary to determine the level of technical competence needed to do the actual building-evaluation work in each disciplinary area.

Proposed examinations of individual capabilities (Sec. 3.2) should result in approvals of management personnel and technical specialists which are recognitions of the actual individuals performing the evaluation rather than the firms themselves. Approvals should be given for a definite period with re-examination at intervals.

While examination of management and technical specialists may be reasonably objective, certain criteria for examining the Analysis Agency are subjective in nature. These include adequate facilities to accomodate the required technical personnel, support staff and technical library. In addition, the management's professional background should be reviewed for any potential conflicts of interest.

3.2 EXAMINING THE ANALYSIS FUNCTION

An institution designed to carry out the Analysis function requires both management/organizational capabilities and competent technical

personnel to perform the building-system evaluations. Figure 1 illustrates the proposed approach to examining the organizational and personnel capabilities.

Examination of the Analysis function is performed by an approved Institution Examining Agency (IEA)[2] in accordance with standard criteria and methodology. The examining agency goes through a two-step process:

- Advance Submittal
- On-Site Visit

During the Advance Submittal Phase, the examining agency reviews information provided by the applicant on the application form[3] and its attachments. This review may include a check of technical references and followup of other sources of pertinent information suggested by the applicant. The application form includes questions covering the following attributes of the applicant institution:

- Organizational Structure and Procedures
- Facilities
- Related Experience
- Technical Resumes
- Subcontractors

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[2]For additional details on the proposed Institution Examining Agency refer to the brochure Appendix B "This is LEAP."

[3]A proposed application form is included in the Appendix. To assist the applicant in interpreting the application form and the requirements of the institutional accreditation program, a suggested "General Information..." sheet has also been included.

EXAMINING THE ANALYSIS FUNCTION

ANALYSIS FUNCTION	EXAMINATION PROCESS		END PRODUCT
	NOW	FUTURE	
ANALYSIS AGENCY ORGANIZATION	IEA ADVANCE SUBMITTAL • ORGANIZATIONAL STRUCTURE & PROCEDURES • RELATED EXPERIENCE • FACILITIES • SUBCONTRACTORS ON-SITE VISIT	IEA ADVANCE SUBMITTAL • ORGANIZATIONAL STRUCTURE & PROCEDURES • RELATED EXPERIENCE • FACILITIES • SUBCONTRACTORS ON-SITE VISIT	REPORT OF FINDINGS TO ADMINISTRATIVE AGENCY
PERSONNEL FROM THE BUILDING SYSTEM DISCIPLINES	IEA CONDITIONAL APPROVAL UNTIL: BASED ON: • EDUCATION • RELATED EXPERIENCE • AUTHORIZED REFERENCE CHECKS • EXAMPLES OF PREVIOUS WORK	CERTIFIED BY: NATIONAL BOARD OF BUILDING SYSTEM EVALUATORS • PEER GROUP 1 • PEER GROUP 2 • PEER GROUP 3 IEA AS SECRETARIAT	REPORT OF FINDINGS TO ADMINISTRATIVE AGENCY

Figure 1

If the completed application reflects a critical limitation in technical capability in relation to the standard criteria, such limitation is brought to the attention of the applicant.

The examining agency schedules an On-Site Visit after all critical deficiencies in the Advance Submittal have been resolved. The purpose of the visit is to collect information, photographs and impressions that can best be obtained through personal interviews and observations.

The examiner is aided in preparing for the On-Site Visit[4] by means of an examiner training program and through his detailed review of the Advance Submittal.

Examination of the organizational aspects of the Analysis function is based on procedures which are readily available and which are expected to change very little after startup of the process. However, as illustrated in Figure 1, the examination approach for Analysis personnel is depicted as undergoing a change between the time of startup of the program (see NOW) and a more advanced stage (see FUTURE).

In the advanced stage, a "National Board of Building System Evaluators" is envisioned, consisting of several peer groups coming together for the purpose of conducting a volunteer examination program for certifying building-system evaluators. Several groups would be needed to adequately

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[4]For a more detailed description of procedures to be used by the examiner, see "Methodology for Examining Testing Laboratories," NBSIR 73-22, June 1972.

represent the varying concerns ranging from the technican to the professional-specialist[5], and covering prescriptive and innovative systems.

At the advanced stage, the examination work of the IEA would primarily be directed to the organizational aspects of the Analysis function, and perhaps to serving as the secretariat to the "National Board of Building System Evaluators." However, since this National Board does not yet exist, the startup mode would require the IEA to perform a more cursory examination of an individual's technical qualifications and provide a conditional certification of technical competence based largely on education, related experience, references and examples of previous work. The conditional certification would expire (____) year(s)[6] after the initiation of peer group certification.

The end product of the examining agency's work is a report of findings regarding the technical capability of the applicant institution to function as an Analysis Agency. This report is used by the Administrative Agency or it's designee as one of the bases[7] for granting or denying accreditation of the applicant institution to act as an Analysis Agency.

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[5] For related work already going on in other fields, see T. deS. Furman, "Specialty Registration for Engineers?," Civil Engineering - ASCE, December 1972.

[6] Time period to be determined by NCSBCS.

[7] It is proposed that examination of the non-technical, business-related aspects of the Criteria be conducted by the State Administrative Agency or its designee. See Section 4.3 The Role of the State and Appendix B This Is LEAP, under "Administrative Agency."

Recommendations for the standard to be used by the Institutional Examining Agency are described in detail in the following task-oriented sections:

- Criteria and Methodology for Examining the Analysis Organization
- Criteria and Methodology for Examining the Management Staff
- Criteria and Methodology for Examining Technical Staff Evaluating Prescribed Product Description Documents
- Criteria and Methodology for Examining Technical Staff Evaluating Innovative Product Description Documents
- Criteria and Methodology for Examining Technical Staff Evaluating Compliance Assurance Documents and,
- Criteria and Methodology for Examining Technical Staff Evaluating Installation Documents.

Each section is arranged by Task[8], Requirement, Criteria and Methodology.

3.3 CRITERIA AND METHODOLOGY FOR EXAMINING THE ANALYSIS ORGANIZATION

Requirement - Provide physical, administrative and financial framework for successfully managing the Analysis function.

Criteria -

A. Facilities - Provide adequate facilities to house support technical personnel, including:

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[8]Task definitions are included only where necessary to clarify the Requirements.

1. Conference space for use of entire evaluation team and meetings with applicants.
2. Space and facilities for plan checking.
3. Equipment for calculations and for checking of calculations.
4. A suitable technical library.
5. Equipment for typing reports and correspondence.
6. Storage facilities for correspondence and reports.

B. Support Staff - Provide adequate secretarial, administrative and managerial staff to support the activities of technical personnel.

C. Information - Provide effective methods for keeping the professional staff technologically current.

D. Financial Capability - Demonstrate the availability of adequate financial resources to support the required facilities, staff and activities.

E. Conflict of Interest - Provide positive evidence of a total absence of potential financial conflict of interest. (See Appendix A Monitoring and Auditing, for a discussion of this issue.)

F. Experience - Provide a substantial background of successful completion of similar work.

Methodology -

A. *Facilities - Adequacy of facilities shall be verified by submitted evidence, and by a field inspection of the applicant's facilities.*

B. *Support Staff - Adequacy of support staff shall be verified by submission of a management and organizational chart.*

C. *Information - Availability of current technological information shall be verified by:*

1. *Memberships in professional and technical societies.*
2. *Subscription to technical and research publications.*
3. *Participation of professional staff in relevant continuing education programs.*

D. *Financial Capability*[7] *- Adequacy of financial resources shall be verified by financial statements and bank references.*

E. *Conflict of Interest*[7] *- Absence of financial sources for conflicts of interest shall be verified by financial statements and other evidence.*

F. *Experience - Successful similar experience shall be verified by project histories and references. Pro-*

ject histories shall indicate specific activities performed by the agencies, and measures of success. They shall also indicate work done by the agency's own professional staff and work done by contract. Care shall be taken in interpreting term "similar experience," in light of the newness of the field of industrialized building evaluation, as well as the potentials of technological transfer from other fields.

3.4 CRITERIA AND METHODOLOGY FOR EXAMINING THE MANAGEMENT STAFF

Task - Provide the services of a project manager in the Analysis function, including:

A. Convening and Conducting the Preliminary Meeting - For the purpose of familiarizing the applicant with the Analysis function, and familiarizing himself with the forthcoming application.

B. Assisting in Preparation of the Control Document - To establish the scope of the submission and the evaluation effort.

C. Determining Need for Performance Specification Submission - Assessing the extent of innovation involved in the forthcoming submission in terms of identifying any part of the proposed product that is beyond the scope of prescribed systems.

D. Staffing of the Analysis Function - Selecting the appropriate team to undertake the forthcoming evaluation, consisting of in-house staff and consultants.

E. Scheduling the Analysis Function Activities - Preparation of a complete management plan for the forthcoming Analysis function effort.

F. Monitoring Progress of Analysis Function Activities - To keep it on schedule and performing effectively.

G. Establishing Contact with Applicant - To become the sole point of contact for receiving and transmitting information, raising and responding to questions, etc.

Requirements -

A. General Expertise in Building Systems and Systems Building - Experience and familiarity with the state-of-the-art of new developments in building hardware and in the building process.

B. Knowledge of Codes and Standards - Thorough understanding of building codes and standards.

C. Knowledge of the Analysis Function - Thorough understanding of the Analysis Agency (of which he is a part) as well as all details of the Analysis function procedure.

3.5 CRITERIA AND METHODOLOGY FOR EXAMINING TECHNICAL STAFF EVALUATING PRESCRIBED PRODUCT DESCRIPTION DOCUMENTS

3.5.1 Structural

Task - Assess the following aspects of the submission against the applicable code for sufficiency:

A. Load Capacity - such as:

1. Vertical Loads
    a. Dead Load
    b. Live Load
    c. Snow Load
    d. Soils - Generally based on an assumed soil load
2. Lateral Loads
    a. Wind Load
    b. Seismic Load
3. Transportation and Handling

    (The Compliance Assurance and Inspection Document should be coordinated with this item.)

B. Stiffness

1. Deflection Limitation

C. Local Damage Resistance

Using:

A. Engineering Drawings - Including plans, elevations, sections and details

C. Ability - Adequate performance on an examination related to the requirements.

D. Desirable traits

1. A Building Generalist - An individual with experience enabling him to view the building process from several points of view; i.e., owner, builder, design professional, etc.
2. Experience in dealing with and managing professional personnel, including work assignment and scheduling.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references. In addition, capability shall be demonstrated in the form of previous reports and tests.

C. Examination - May be written or oral (before a board.) The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination. This examination shall test synthesis as well as analysis ability.

F. Knowledge of the Analysis Process - Understanding and appreciation of the Analysis unction process.

Criteria -

A. Education - A bachelor's degree in civil engineering with specialized course work in structures.

B. Experience

1. One year as a structural plan check engineer, or proposal evaluator;

or 2. Two years as a structural design engineer;

or 3. Two years of field structural engineering experience.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references.

C. Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination.

B. Engineering Calculations

C. Test Reports - May relate to a particular subsystem or subassembly within the structure.

D. Materials and Product Specifications - Only partially complete in the Product Description Document. Complete specifications will be used by the Compliance Assurance Agency, and accompany the Compliance Assurance Manual.

E. Site and climate-related load data.

Requirements -

A. Knowledge of Codes and Standards - Knowledge of structural provisions of the applicable codes and standards, including geographic distribution of various load conditions including packing, vibrations, and others imposed during transportation.

B. Knowledge of Structural Engineering - Understanding of conventional structural engineering principles and practices.

C. Ability to Interpret Drawings - Ability to read and interpret drawings for code compliance, completeness, and coordination with calculations.

D. Analytical Ability - Ability to evaluate calculations for compliance with the applicable codes and standards.

E. Ability to Evaluate Reports - Ability to evaluate test reports for validity and compliance with code and specification requirements.

E. Site- and climate-related load data.

F. Operation profile (energy input-output).

Requirements -

A. Knowledge of Codes and Standards - Knowledge of the mechanical provisions of the applicable codes and standards, including geographic distribution of various load conditions.

B. Knowledge of Mechanical Engineering - Understanding of accepted mechanical engineering practices, including equipment operation under dynamic conditions.

C. Ability to Interpret Drawings - Ability to read and interpret drawings for code compliance and completeness.

D. Analytical Ability - Ability to evaluate calculations for compliance with applicable codes and standards.

E. Ability to Evaluate Reports - Ability to evaluate test reports for validity and compliance with code and specification requirements.

F. Knowledge of the Analysis Process - Understanding and appreciation of the Analysis function process.

Criteria -

A. Education - A bachelor's degree in mechanical engineering.

B. Experience

1. One year as a mechanical plan examiner or proposal evaluator;

or 2. Two years as a mechanical design engineer.

3.5.2 MECHANICAL (HVAC)

Task - Assess the following aspects of the submittal against the applicable code for sufficiency:

A. Adequacy For Use

1. Thermal Comfort
2. Ventilation
3. Extreme Temperature

B. Operation

1. Ease of Service
2. Economy of Maintenance

C. Health, Safety, and Fire Safety

1. Accident Prevention
2. Ignition Prevention

D. Energy Consumption and Pollution

Using:

A. Engineering Drawings including plans, elevations, sections and details.

B. Engineering Calculations.

C. Test Reports - May relate to a particular subsystem or subassembly within the mechanical systems.

D. Material and Product Specifications and Manufacturers' Literature - Only partially complete in the Product Description Document. Complete specifications accompany the Compliance Assurance Document.

3.5.3 Electrical

Task - Assess the following aspects of the submission against the applicable code for sufficiency:

A. Adequacy For Use

1. Illumination
2. Spatial Relationships (Arrangement)

B. Operation

1. Ease of Service
2. Economy of Maintenance

C. Health, Safety, and Fire Safety

1. Accident Prevention
2. Ignition Prevention
3. Vermin Penetration Resistance

D. Energy Consumption

Using:

A. Drawings including plans, elevations, sections and details.

B. Calculations.

C. Test Reports - May relate to a particular subsystem or subassembly within the electrical systems.

D. Material and Product Specifications - Only partially complete in the Product Description Document. Complete specifications accompany the Compliance Assurance Manual.

NOTE: In lieu of engineering degree, 5 years of mechancal plan examiner experience or 5 years as a mechanical contractor may be substituted.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references.

C. Examination - May be written or oral (before a board.) The Applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination.

or 2. Two years of additional journeyman experience may be substituted for the plan examining experience.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references.

C. Examination - May be written or oral (before a board). The Applicant shall answer adequately relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination.

Requirements -

A. Knowledge of Codes and Standards - Knowledge of electrical provisions of the applicable codes and standards.

B. Knowledge of Electrical Practices - Understanding of conventional electrical construction principles and practices.

C. Ability to Interpret Drawings - Ability to read and interpret drawings for code compliance, completeness and coordination with calculations.

D. Analytical Ability - Ability to evaluate the calculations for compliance with the applicable codes and standards.

E. Ability to Evaluate Reports - Ability to evaluate test reports for validity and compliance with code and specification requirements.

F. Knowledge of the Analysis Process - Understanding and appreciation of the Analysis function process.

Criteria -

A. Education - Equivalent to graduation from high school. Some junior college or trade school (Engineering) training desirable.

B. Experience

1. One year as an electrical plan examiner and five years as a journeyman electrician;

Requirements -

A. Knowledge of Codes and Standards - Knowledge of plumbing provisions of the applicable codes and standards.

B. Knowledge of Plumbing Practices - Understanding of conventional plumbing systems and practices.

C. Ability to Interpret Drawings - Ability to read and interpret drawings for compliance with the applicable codes and standards.

D. Analytical Ability - Ability to evaluate calculations for compliance with the applicable codes and standards.

E. Ability to Evaluate Reports - Ability to evaluate test reports for validity and compliance with code and specification requirements.

F. Knowledge of the Analysis Process - Understanding and appreciation of the Analysis function process.

Criteria -

A. Education - Equivalent to graduation from high school. Junior college or trade school training desirable.

B. Experience

1. Eight years field experience including five years as a journeyman or master;

or 2. One year plumbing plan examination and five years as a journeyman plumber;

3.5.4 Plumbing

Task - Assess the following aspects of the submission against the applicable code for sufficiency:

A. Adequacy For Use

1. Spatial Relationships (Arrangement)
2. Configuration

B. Operation

1. Ease of Service
2. Economy of Maintenance

C. Health and Safety

1. Sanitation
2. Fire Resistance
3. Foreign Media Penetration Resistance

D. Water Conservation (possible future requirement)

Using:

A. Drawings including plans elevations, sections and details.

B. Calculations (where applicable).

C. Test Reports - May relate to a particular subsystem or subassembly within the plumbing systems.

D. Material and Product Specifications - Only partially complete in the Product Description Document. Complete specifications accompany the Compliance Assurance Documents.

3.5.5 Architectural - Health and Safety

Task - Assess the following aspects of the submission against the applicable code for sufficiency:

A. Adequacy For Use

1. Dimension/Configuration
2. Spatial Relationships
3. Adequacy for Storage
4. Illumination
5. Acoustics
6. Ventilation
7. Thermal Comfort
8. Foreign Media Penetration

B. Durability

1. Deterioration Resistance
2. Economy of Maintenance
3. Ease of Service

C. Health and Safety

1. Dimension/Configuration
2. Sanitation
3. Accident Prevention

Using:

A. Drawings including plans, elevations, sections, details and schedules.

or 3. Four years of plumbing design experience.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references.

C. Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination.

Criteria -

A. Education - Equivalent to two years of engineering or architecture.

B. Experience

1. One year plan evaluation experience;

or 2. Two years building design experience.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references.

C. Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination.

B. Area and other dimensional calculations.

C. Test Reports - May relate to a particular subsystem or subassembly within the total building.

D. Material and Product Specifications - Only partially complete in the Product Description Document. Complete specifications accompany the Compliance Assurance Document.

E. Samples.

Requirements -

A. Knowledge of Codes and Standards - Knowledge of architectural and health and safety provisions of the applicable codes and standards.

B. Knowledge of Construction Practices - Understanding of conventional construction principles and practices.

C. Ability to Interpret Drawings - Ability to read and interpret drawings for code compliance, completeness, coordination with calculations, and consistency.

D. Analytical Ability - Ability to evaluate dimensional calculations for compliance with the applicable codes and standards.

E. Ability to Evaluate Reports - Ability to evaluate test reports for validity and compliance with code and specification requirements.

F. Knowledge of the Analysis Process - Understanding and appreciation of the Analysis function process.

and standards including site-related attributes imposed by Fire Zone locations.

B. Knowledge of Fire Safety Practices - Understanding of conventional fire safety practices.

C. Ability to Interpret Drawings - Ability to read and interpret drawings for code compliance, completeness, coordination and accuracy.

D. Analytical Ability - Ability to evaluate calculations for compliance with the applicable codes and standards.

E. Ability to Evaluate Reports - Ability to evaluate test reports for validity and compliance with code requirements. Review test specimens for compliance with test reports.

F. Knowledge of the Analysis Process - Understanding and appreciation of the Analysis function process.

Criteria -

A. Education - High school or equivalent; additional junior college training desirable.

B. Experience

1. One year plan review experience;

or 2. Two years as a fire prevention officer.

C. Ability - Adequate performance on an examination related to the requirements.

3.5.6 Fire Safety

Task - Assess the following aspects of the submission against the applicable code for sufficiency:

A. Egress Adequacy

B. Fire Resistance

C. Flame Spread (Combustibility)

D. Smoke Generation

E. Toxicity

F. Fuel Content

G. Ignition Prevention

H. Dimension/Configuration

I. Fire Protectives (Fire door, windows, etc.)

Using:

A. Drawings including plans, elevations, sections, details and schedules.

B. Calculations.

C. Test Reports - May relate to a particular subsystem or subassembly within the building.

D. Material and Product Specifications - Only partially complete in the Product Description Document. Complete specifications accompany the Compliance Assurance Document.

Requirements -

A. Knowledge of Codes and Standards - Knowledge of fire safety provisions of the applicable codes

3.5.7 Acoustics

Introductory statement - Acoustic requirements did not form an explicit part of the codes surveyed for this study nor are they included in most current building codes. However, the current trends in codes, standards and other guidelines (e.g., FHA standards) indicate a growing concern for acoustical environmental quality, and it is for this reason that the following requirements and criteria are included here.

Task - Assess the following aspects of the submission against the applicable code for sufficiency:

A. Control of sound generating parts of the proposed system (e.g., mechanical equipment).

B. Control by parts of the proposed system of sounds generated within the dwelling by normal use.

C. Control by parts of the proposed system of sounds generated outside the dwelling.

Using:

A. Drawings including plans, elevations, sections, details and schedules.

B. Calculations.

C. Test Reports - May relate to a particular subsystem or subassembly within the building.

D. Material and Product Specification - Only partially complete in the Product Description Document. Complete specifications accompany the Compliance Assurance Document.

E. Site-related data (ambient noise levels).

F. Samples.

Requirements -

A. Knowledge of Codes and Standards - Knowledge of acoustic provisions of the applicable codes and standards including site-related attributes imposed by ambient noise levels as a function of proximity to noise-generating sources.

B. Knowledge of Acoustics Practices - Understanding of conventional architectural acoustics practices.

C. Ability to Interpret Drawings - Ability to read and interpret drawings for code compliance, completeness, coordination and accuracy.

D. Analytical Ability - Ability to evaluate calculations for compliance with the applicable codes and standards.

E. Ability to Evaluate Reports - Ability to evaluate test reports for validity and compliance with code requirements. Review test specimens for compliance with test reports.

F. Knowledge of the Analysis Process - Understanding and appreciation of the Analysis function process.

Criteria -

A. Education - Equivalent to graduation from high school. Some junior college or trade school (engineering) training desirable.

B. Experience

1. One year plan review experience and three years of acoustic product testing, development related experience;

or 2. Two years of additional acoustic product experience may be substituted for the plan review experience.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references.

C. Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination.

3.6 CRITERIA AND METHODOLOGY FOR EXAMINING TECHNICAL STAFF EVALUATING INNOVATIVE PRODUCT DESCRIPTION DOCUMENTS

3.6.1 Structural

I. Performance Specification Evaluation

Task - Assess the adequacy of the performance specifications to carry out the intent of the applicable code.

Subtask I - Assess the requirements and criteria for adequacy.

Using:

A. Code Intent Statement - An explicit statement of the intent of the applicable code with regard to structural safety and serviceability. The intent should describe the general concepts of loads and stiffness, as well as durability, and the health and safety requirements.

B. Performance Specifications - Comparison with previous performance specifications.

C. Reference Material - Applicable reference materials such as other codes and standards, similar specifications, technical books and journals.

D. Interface With Conventional Materials - A review of connection materials and their environment. Determine need for special connections or protective measures.

Requirements -

A. Knowledge of Code - Knowledge of the intent of the applicable code. Thorough understanding of the intent of the structural provisions of the applicable code, as well as an understanding of the general concepts of health and safety requirements.

B. Knowledge of Research Methods - Access to related reference material and understanding of reference search methods.

C. Advanced Structural Concepts - Knowledge of state-of-the-art advanced structural concepts. Awareness of current structural research relative to the material and process.

D. Design Perception - Design perception relative to the proposal must be used to anticipate potential areas of incompatability. Areas of potential failure relative to the structure, other systems and the occupants should be anticipated and reviewed.

E. Building Process - Understanding how the constraints of procurement leadtime and accessibility for sequential assembly operations influence the design selection of components and their interface connections.

Subtask II - Assess the proposed tests for adequacy in demonstrating compliance with the proposed criteria.

Using:

A. Detailed test method write-ups of each proposed test.

B. Proposed structural calculation theory.

C. Texts on the rationale and history of structural calculation and simulation methods.

Requirements -

A. Proposals for Performance Testing - Ability to evaluate the appropriateness of the test method proposed for the innovative system or material in terms of validity, reliability, sampling, etc.

B. Results of Performance Testing - Knowledge of testing, equipment and methods and evaluation of testing to performance specifications. An understanding of test methods and their applicability to different materials is essential.

C. Accepted Engineering Procedures - Knowledge of accepted engineering prcedures and their applicability procedures and their applicability to new and innovative materials. The appropriateness of analysis by calculations versus physical testing for these materials is a critical analysis phase determination.

Criteria -

A. Education - A bachelor's degree in civil engineering with specialization in structures.

B. Experience

1. Four years of recent structural plans evaluation experience with a minimum of one year in evaluating innovative materials and systems;

or 2. Five years in recent structural design experience including a minimum of two years in the design and evaluation of innovative systems.

NOTE: A master's degree may be substitutued for one year of the required experience.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references. In addition, capability shall be demonstrated in the form of previous reports and tests.

C. Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements. Failure

on any one of the requirements shall be deemed failure of the examination. This exam shall test synthesis as well as analysis ability.

II. Product Evaluation

Requirements, criteria and methodology here are the same as those for Prescribed Product Description Documents (See 3.5.1), except that the evaluation uses the proposed and approved performance specification instead of the codes and standards.

Since calculations and test reports with innovative systems may be more complicated, the evaluator must have the ability to follow and assess such calculations and test reports.

3.6.2 MECHANICAL (HVAC)

I. Performance Specification Evaluation

Task - Assess the adequacy of the performance specifications to carry out the intent of the applicable code.

Subtask I - Assess the proposed requirements and criteria for adequacy.

Using:

A. Code Intent Statement - An explicit statement of the intent of the applicable code with regard to thermal and atmospheric comfort and environmental impact as well an an understanding of the general health and safety requirements.

B. Performance Specifications - Comparison with previous performance specifications.

C. Reference Material - Applicable reference materials such

as other codes and standards, similar specifications, technical books and journals.

D. Interface with Conventional Materials - A review of connection materials and their environment. Determine need for special connection or protective measures.

Requirements -

A. Knowledge of the Intent of the Applicable Code - Thorough understanding of the intent of the mechanical provisions of the applicable code. The intent should describe the general concepts of ventilation and comfort, as well as durability, and health and safety.

B. Access to Related Reference Material - Adequate reference material and understanding of reference search methods.

C. Advanced Mechanical Systems Concepts - Knowledge of the state-of-the-art advanced mechanical systems concepts. Awareness of current heating, ventilating and air conditioning research relative to the material and processes in question.

D. Design Perception - Design perception relative to the proposal to anticipate potential areas of incompatibility. Areas of potential failure relative to the mechanical systems and the occupants should be anticipated and reviewed.

E. Building Process - Understanding how the constraints of procurement leadtime and accessibility for sequential assembly operations influence the design selection of components and their interface connections.

Subtask II - Assess the proposed tests for adequacy in demonstrating compliance with the proposed criteria.

Using:

A. Detailed test method writeups of each proposed test.

B. Texts on the rationale and history of thermal and atmospheric testing, calculation and simulation.

Requirements -

A. Proposals for Performance Testing - Ability to evaluate the appropriateness of the test method proposed for the innovative system or material in terms of validity, reliability, sampling, etc.

B. Results of Performance Testing - Knowledge of testing, equipment and methods and evaluation of testing to performance specifications. An understanding of test methods and their applicability to different materials is essential.

C. Accepted Engineering Procedures - Knowledge of accepted engineering procedures and the applicability to new and innovative materials. The appropriateness of analysis by calculations versus physical testing for these materials is a critical analysis phase determination.

Criteria -

A. Education - A bachelor's degree in mechanical engineering.

B. Experience

1. Four years of recent mechanical plans evaluation experience with a minimum of one year in evaluating

innovative materials and systems

or 2. Five years in recent mechanical design experience including a minimum of two years in the design and evaluation of innovative systems.

NOTE: A master's degree may be substituted for one year of the required experience.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references. In addition, capability shall be demonstrated in the form of previous reports and tests.

C. Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination. This examination shall test synthesis as well as analysis ability.

COMMENTARY: Design experience of innovative systems should involve new methods and materials rather than the assembly of standard "catalog" items.

II. Product Evaluation

Requirements, criteria and methodology here are the same as those for Prescribed Product Description Documents (See 3.5.2), except that the evaluation uses the proposed and approved performance specification instead of the codes and standards.

Since calculations and test reports may be used more extensively with innovative systems and may be more complicated, the evaluator must have the ability to follow and assess such calculations and test reports.

3.6.3 Electrical

I. Performance Specification Evaluation

Task - Assess the adequacy of the performance specifications to carry out the intent of the applicable code.

Subtask I - Assess the proposed requirements and criteria for adequacy.

Using:

A. Code Intent Statement - An explicit statement of the applicable code with regard to electrical serviceability and safety. The intent should describe the general concepts of illumination, as well as durability and the health and safety requirements.

B. Performance Specifications - Comparison with previous performance specifications.

C. Reference Material - Applicable reference materials such as other codes and standards, similar specifications, technical books and journals.

D. Interface with Conventional Materials - A review of connection materials and their environment. Determine need for special connections or protective measures.

Requirements -

A. Knowledge of the Intent of the Applicable Code - Thorough understanding of the intent of the electrical portions of the applicable code as well as an understanding of the general concepts of health and safety requirements.

B. Access to Related Reference Material - Adequate reference material and understanding of reference search methods.

C. Advanced Electrical Concepts - Knowledge of the state-of-the-art of advanced electrical concepts. Awareness of current electrical research relative to the material and process in question.

D. Design Perception - Design perception relative to the proposal must be used to anticipate potential areas of incompatibility. Areas of potential failure relative to the electrical systems and the occupants should be anticipated and reviewed.

E. Building Process - Understanding how the constraints of procurement leadtime and accessibility for sequential assembly operations influence the design selection of components and their interface connections.

Subtask II - Assess the proposed tests for adequacy in demonstrating compliance with the proposed criteria.

Using:

A. Detailed test method write-ups of each proposed test.

B. Text on the rationale and history of electrical testing, calculation and simulation.

Requirements -

A. Proposals for Performance Testing - Ability to evaluate the appropriateness of the test method proposed for the innovative system or material, in terms of validity, reliability, sampling, etc.

B. Results of Performance Testing - Knowledge of testing, equipment and methods and evaluation of testing to performance specifications. An understanding of test methods and their applicability to different materials is essential.

C. Accepted Engineering Procedures - Knowledge of accepted engineering procedures and the applicability to new and innovative materials. The appropriateness of analysis by calculations versus physical testing for these materials is a critical analysis phase determination.

Criteria -

A. Education - A bachelor's degree in electrical engineering.

B. Experience -

1. Four years of recent electrical plans evaluation experience with a minimum of one year in evaluating innovative materials and systems;

or 2. Five years in recent electrical design experience including a minimum of two years in the design and evaluation of innovative systems.

NOTE: A master's degree may be subsituted for one year of the required experience.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references. In addition, capability shall be demonstrated in the form of previous reports and tests.

C. Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination. This examination shall test synthesis as well as analysis ability.

II. Product Evaluation

Requirements, criteria and methodology here are the same as those for Prescribed Product Description Documents (See 3.5.3), except that the evaluation uses the proposed and approved performance specification instead of the codes and standards.

Since calculations and test reports with innovative systems may be more complicated, the evaluator must have the ability to follow and assess such calculations and test reports.

3.6.4 Plumbing

I. Performance Specification Evaluation

Task - Assess the adequacy of the performance specifications to carry out the intent of the applicable code.

Subtask I - Assess the proposed requirements and criteria for adequacy.

Using:

A. Code Intent Statement - An explicit statement of the intent of the applicable code with regard to plumbing network serviceability and effectiveness. The intent should describe the general concepts of spatial relationships as well as the health and safety requirements.

B. Performance Specifications - Comparison with previous performance specifications.

C. Reference Material - Applicable reference materials such as other codes and standards, similar specifications, technical books and journals.

D. Interface with Conventional Materials - A review of connection materials and their environment. Determine need for special connections or protective measures.

Requirements -

A. Knowledge of the Intent of the Applicable Code - Thorough understanding of the intent of the plumbing portion of the applicable code as well as an understanding

of the general concepts of health and safety requirements.

B. Access to Related Reference Material - Adequate reference material and understanding of reference search methods.

C. Advanced Plumbing Engineering Concepts - Knowledge of the state-of-the-art of advanced plumbing concepts. Awareness of current plumbing research relative to the materials and processes in question.

D. Design Perception - Design perception relative to the proposal to anticipate potential areas of incompatibility. Areas of potential failure relative to the structure, other systems and the occupants should be anticipated and reviewed.

E. Building Process - Understanding how the constraints of procurement leadtime and accessibility for sequential assembly operations influence the design selection of components and their interface connections.

Subtask II - Assess the proposed tests for adequacy in demonstrating compliance with the proposed criteria.

Using:

A. Detailed test method write-ups of each proposed test.

B. Texts on the rationale and history of plumbing system testing, calculation and simulation.

Requirements -

A. Proposals for Performance Testing - Ability to evaluate the appropriateness of the test method proposed for the innovative system or material in terms of validity, reliability, sampling, etc.

B. Results of Performance Testing - Knowledge of testing,

equipment and methods and evaluation of testing to performance specifications. An understanding of test methods and their applicability to different materials is essential.

C. Accepted Engineering Procedures - Knowledge of accepted engineering procedures and the applicability to new and innovative materials. The appropriateness of analysis by calculations versus physical testing for these materials is a critical analysis phase determination.

Criteria -

A. Education - A bachelor's degree in either civil or mechanical engineering.

B. Experience

1. Four years of recent plumbing plans evaluation experience with a minimum of one year in evaluation of innovative materials and systems;

or 2. Five years in recent plumbing design experience including a minimum of two years in the design and evaluation of innovative systems.

NOTE: A master's degree may be substituted for one year of the required experience.

C. Ability - Adequate performance on an examination related of the required experience.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a

detailed resume including a minimum of three references. In addition, capability shall be demonstrated in the form of previous reports and tests.

C. *Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination. This examination shall test synthesis as well as analysis ability.*

II. Product Evaluation

Requirements, criteria and methodology here are the same as those for Prescribed Product Description Documents (See 3.5.4), except that the evaluation used the proposed and approved performance specification instead of the codes and standards.
Since calculations and test reports with innovative systems may be more complicated, the evaluator must have the ability to follow and assess such calculations and test reports.

3.6.5 ARCHITECTURAL - HEALTH and SAFETY

I. Performance Specification Evaluation

Task - Assess the adequacy of the performance specifications to carry out the intent of the applicable code.

Subtask I - Assess the proposed requirements and criteria for adequacy.

Using:

A. Code Intent Statement - An explicit statement of the intent of the applicable code with regard to comfort, health and

safety, adequacy for use, etc. The intent should describe the general concepts of spatial relationships for usability, comfort, adequacy for use, as well as durability and health and safety requirements.

B. Performance Specifications - Comparison with previous performance specifications.

C. Reference Material - Applicable reference materials such as other codes and standards, similar specifications, technical books and journals in the area of human factors, domestic accidents, comfort, etc.

D. Interface with Conventional Materials - A review of connection materials and their environment. Determine need for special connections or protective measures.

Requirements -

A. Knowledge of the Intent of the Applicable Code - Thorough understanding of the intent of the general provisions of the applicable code.

B. Access to Related Reference Material - Adequate reference material and understanding of reference search methods in the areas of human factors, comfort, etc.

C. Advanced Building Concepts - Knowledge of the state-of-the-art of advanced building concepts. Awareness of current building research if relative to the material and process in question, as well as to advanced spatial concepts.

D. Design Perception - Design perception relative to the proposal to anticipate potential areas of incompatibility. Areas of potential failure relative to any part of the

building and the occupants should be reviewed.

E. Building Process - Understanding how the constraints of procurement leadtime and accessibility for sequential assembly operations influence the design selection of components and their interface connections.

Subtask II - Assess the proposed tests for adequacy in demonstrating compliance with the proposed criteria.

Using:

A. Detailed test method write-ups of each proposed test. It is assumed that most architecture, health and safety tests, except those for weathering and deterioration, will be observation tests of architectural drawings, models or fullscale buildings.

B. Texts on the rationale and history of human factors and comfort testing, calculation and simulation, as well as physical testing of building components.

Requirements -

A. Proposals for Performance Testing - Ability to evaluate the appropriateness of the test method proposed for the innovative system or material, in terms of validity, reliability, sampling, etc.

B. Results of Performance Testing - Knowledge of testing, equipment and methods and evaluation of testing to performance specifications. An understanding of test methods and their applicability to different materials is essential.

C. Accepted Building Procedures - Knowledge of accepted procedures and the applicability to new and innovative materials. The appropriateness of analysis by calculation versus physical testing for these materials is a critical analysis phase determination.

Criteria -

A. Education - A bachelor's degree in architecture or engineering.

B. Experience

1. Four years of recent architectural (health and safety) plans evaluation experience with a minimum of one year in evaluating innovative materials and systems;

or 2. Five years of recent building design experience including a minimum of two years in the design and evaluation of innovative systems.

NOTE: A master's degree may be substituted for one year of the required experience.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references. In addition, capability shall be demonstrated in the form of previous reports and tests.

C. Examination - May be written or oral (before board).

The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination. This exam shall test synthesis as well as analysis ability.

II. Product Evaluation

Requirements, criteria and methodology here are the same as those for Prescribed Product Description Documents (See 3.5.5), except that the evaluation uses the proposed and approved performance specification instead of the codes and standards.
Since calculations and test reports with innovative systems may be more complicated, the evaluator must have the ability to follow and assess such calculations and test reports.

3.6.6 Fire Safety

I. Performance Specification Evaluation

Task - Assess the adequacy of the performance specifications to carry out the intent of the applicable code.

Subtask I - Assess the requirements and criteria for adequacy.

Using:

A. Code Intent Statement - Ana explicit statement of the intent of the applicable code relative to life safety, structural protection and durability, and protection of building and contents in case of fire.

B. Performance Specification - Comparison with previous performance specifications.

C. Fire research Reference Material - Applicable reference materials such as other codes and standards, similar specifications, technical books and journals.

D. Interface with Conventional Materials - A review of connection materials and their environment. Determine need for special connections or protective measures.

Requirements -

A. Knowledge of the Intent of the Applicable Code - Thorough understanding of the intent of the life safety provisions of applicable codes as well as an understanding of the general concepts of health and safety requirements.

B. Access to Related Reference Material - Adequate reference material and understanding of reference search methods in fire research.

C. Advanced Fire Safety Concepts - Knowledge of the state-of-the-art of advanced fire concepts. Awareness of current research relative to the material and process in question.

D. Design Perception - Design perception relative to the proposal, to anticipate potential areas of incompatibility. Areas of potential failure relative to fire hazard and its effects on life safety and the integrity of the structure should be anticipated and reviewed.

E. Building Process - Understanding how the constraints of procurement leadtime and accessibility for sequential assembly operations influence the design selection of materials, components and their interface connections.

F. Systems Approach - Knowledge, understanding and use of the systems approach to fire safety.

Subtask II - Assess the proposed tests for adequacy in demonstrating compliance with the proposed criteria.

Using:

A. Detailed test method write-ups of each proposed test.

B. Texts on the rationale and history of fire testing, calculation and simulation.

Requirements -

A. Proposals for Performance Testing - Ability to evaluate the appropriateness of the test method proposed for the innovative system or material, in terms of validity, reliability, sampling, etc.

B. Results of Performance Testing - Knowledge of testing, equipment and methods, and evaluation of testing to performance specifications. An understanding of test methods and their applicability to different materials is essential.

C. Accepted Fire Safety Engineering Procedures - Knowledge of accepted fire safety engineering procedures and applicability to new and innovative materials.

Criteria -

A. Experience/Education

1. Eight years of recent fire safety plans evaluation experience with a minimum of one year in evaluating innovative materials and systems ;

or 2. Nine years in recent fire and safety design experience including a minimum of two years in the design and

evaluation of innovative systems.

NOTE: a. A bachelor's degree in an appropriate scientific or engineering specialty may be substituted for a maximum of four years of the required experience.

b. A master's degree in the appropriate specialty may be substituted for an additional year of required experience.

c. A bachelor's degree in fire protection engineering may be substituted for a maximum of five years of the required experience.

d. Design experience should be broadbased rather than design of one system such as automatic fire sprinklers.

B. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references.

C. Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure on the examination.

This examination shall test synthesis as well as analysis ability.

Commentary: Fire engineering is extremely diverse and involves many disciplines and areas of expertise. As a result, no one formal degree could define the appropriate individual. Therefore, experience is the perferred qualification with credit given for education where appropriate.

II. Product Evaluation

Requirements, criteria and methodology here are the same as those for Prescribed Product Description Documents (See 3.5.6), except that the evaluation uses the proposed and approved performance specifications instead of the codes and standards.

Since calculation and test reports with innovative systems may be more complicated, the evaluator must have the ability to follow and assess such calculations and test reports.

3.6.7 Acoustics

I. Performance Specification Evaluation

Task - Assess the adequacy of the performance specifications to carry out the intent of the applicable code.

Subtask I - Assess the requirements and criteria for adequacy.

Using:

A. Code Intent Statement - An explicit statement of the intent of the applicable code relative to acoustical comfort.

B. Performance Specifications - Comparison with previous performance specifications.

C. Acoustical Research Reference Material - Applicable reference materials such as other codes and standards, similar specifications, technical books and journals.

D. Interface with Conventional Materials - A review of connection components and their acoustical environment. Determine need for special isolation.

Requirements -

A. Knowledge of the Intent of the Applicable Code - Thorough understanding of the intent of the acoustic provisions of the applicable code as well as an understanding of the general concepts of health and safety and comfort requirements.

B. Access to Related Reference Materials - Adequate reference material and understanding of reference search methods in acoustical research.

C. Advanced Acoustics Concepts - Knowledge of the state-of-the-art of advanced acoustics concepts. Awareness of current research relative to the material and process in question.

D. Design Perception - Design perception relative to the proposal to anticipate potential areas of incompatibility. Areas of potential failure relative to sound generation, sound attenuation and sound isolation should be anticipated and reviewed. In particular, this must include a keen awareness of the relationships between interior and exterior ambient noise levels, sound generation and acoustic environments.

E. Building Process - Understanding how the constraints of procurement leadtime and accessibility for sequential assembly operations influence the design selection of materials, components and their connections.

F. Systems Approach - Knowledge, understanding and use of the systems approach in acoustical analysis.

Subtask II - Assess the proposed tests for adequacy in demonstrating compliance with the proposed criteria.

A. Detailed method write-ups of each proposed test.

B. Texts on the rationale and history of acoustical testing, calculation and simulation.

Requirements -

A. Proposals for Performance Testing - Ability to evaluate the appropriateness of the test method proposed for the innovative system or material in terms of validity,

reliability, sampling, etc.

B. Results of Performance Testing - Knowledge of testing, equipment and methods and evaluation of testing to performance specifications. An understanding of test methods and their applicability to different materials is essential.

C. Accepted Architectural Acoustics Procedures - Knowledge of accepted acoustical engineering procedures and the applicability to new and innovative materials is necessary.

Criteria -

A. Education - A bachelor's degree in physics, architectural engineering or architecture.

B. Experience

1. Four years of recent acoustic plans evaluation experience with a minimum of one year in evaluating the acoustical attributes of innovative materials and systems;

or 2. Five years of recent architectural acoustics design experience including a minimum of two years in the design and evaluation of innovative systems.

NOTE: A master's degree may be substituted for one year of required experience.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. *Education - Shall be verified by certified proof of graduation or other written confirmation.*

B. *Experience - Shall be verified by submission of a detailed resume including a minimum of three references. In addition, capability shall be demonstrated in the form of previous reports and tests.*

C. *Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements Failure on any one of the requirements shall be deemed failure on the examination. This examination shall test synthesis as well as analysis ability.*

II. Product Evaluation

Requirements, criteria and methodology here are the same as those for Prescribed Product Description Documents (See 3.5.7), except that the evaluation uses the proposed and approved performance specifications instead of the codes and standards.

Since calculation and test reports with innovative systems may be more complicated, the evaluator must have the ability to follow and assess such calculations and test reports.

3.7 CRITERIA AND METHODOLOGY FOR EXAMINING TECHNICAL STAFF EVALUATING COMPLIANCE ASSURANCE MANUALS

Under the Model Manufactured Building Act and the attendant Rules and Regulations, the Analysis (i.e, Evaluation) Agency is charged with approving the Compliance Assurance Manual. The Tasks, Requirements, Criteria and Methodology for fulfilling this responsibility apply as well to the Compliance Assurance Agency task of review of the manufacturer's Compliance Control Document. It is the responsibility of the Analysis function to review and approve both the Compliance Assurance Manual and the incorporated Compliance Control Document, particularly as they relate to the specific concerns brought out during analysis of the other submittal documents. (See 2.3.)

Task - Assess the following aspects of the Compliance Assurance Manual relative to the product's code compliance:

A. Integrity of Raw Material Supply - Verification of methods for acceptance or rejection of incoming materials for damage and compliance with purchase documents.

B. Integrity of Raw Materials Storage and Handling - Verification that equipment and facilities for storage and handling of raw materials has been provided for. Storage facilities should provide weatherproof space for materials that may be damaged by weather and materials whose moisture content must be controlled.

C. Assembly/Fabrication - Checking of fabrication or assembly sequence for appropriateness of inspection

locations. Verification that systems are not covered prior to any required test or inspection. The system should be reviewed for the appropriate means of replacing or repairing unacceptable materials to control damage or disassembly of previously accepted portions.

D. Product Storage and Handling - The method of storage and handling accepted products prior to shipment must be reviewed for adequacy. The method of weatherproofing units to be stored outside, the means of transporting the units from the assembly area to the storage area, and the ongoing means of rechecking the product's integrity during storage must be checked.

E. Product Transportation - The method of transporting the product from the assembly site to the installation site must be reviewed. Some items to be checked include: potential impact loads on all the building systems; required bracing and anchoring in-transit; adequacy of weather protection in-transit; and height and width of units based on transportation means.

Using:

A. Approved Design and Shop (fabrication) Drawings - The design drawings are part of the Product Description Document. Fabrication drawings, while helpful, may not be available at the time of consideration of the Compliance Assurance Manual.

B. Specifications and Manufacturer's Literature - More complete specifications than those approved with

the Product Description Document are utilized in this review. Manufacturer's installation literature is also used at this point.

C. Manufacturer's Inspection Manual - (Part of the Compliance Control Document -- See 2.3.4.) The document detailing inspection tasks to be performed at various assembly and subassembly points is reviewed for completeness.

D. Tests - Verification tests on various building materials and systems and their appropriateness.

E. Plant and Manufacturing Process Layout Drawings.

Requirements -

A. Understanding of Materials in Proposed System - Experience with the specific materials proposed, such as their characteristics and attributes.

B. Understanding of Production Techniques Applicable to Specific Submission - Knowledge of construction assembly and fabrication.

C. Ability to Read and Interpret Drawings and Other Documents - Understanding of engineering design drawings, specifications and other documents (inspection manual, etc.). Ability to evaluate such manuals and drawings for sufficiency.

D. Applicability of Proposed Tests - Review of test proposed for appropriateness as well as frequency, type of sampling, and other test parameters.

E. Understanding of Quality Assurance Theory - General

appreciation and understanding of quality assurance methods and concepts and an understanding of their application to the specific compliance assurance process proposed.

F. Ability to Anticipate Modes of Failure - The process design perception providing the evaluator with an understanding of where materials and products undergoing a process may fail, and leading to the understanding of need for preventative measures, monitoring or inspection.

Task II - Assess the manufacturer's capabilities to implement and to manage the proposed processes covered in the Compliance Control Document.

Using:

A. Management plan of the Control Document.

B. Compliance Control Section of the Compliance Assurance Manual.

Requirement - Understanding of Process Management - The ability to judge an organization's capability to perform, based on its management and administrative structure.

Task III - Assess the adequacy of the Compliance Assurance Agency's program to monitor and to communicate the effectiveness of the manufacturer's compliance control program.

Using:

A. Management plan of the Control Document.

B. Compliance Assurance Section of the Compliance.

Assurance Manual.

Requirement - Understanding of the Compliance Assurance Function and the inter-relationships of responsibility and authority between the manufacturer, the building-evaluation agencies, and the Administrative Agency

Citeria -

A. Education - A bachelor's degree in one of the following:

1. Architect and Engineer
2. Quality Assurance Engineer
3. Industrial Engineer

B. Experience -

1. Two years construction or factory production experience with the various raw materials proposed.

or 2. Two years experience and understanding of tests and test methods relative to construction.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references.

C. Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements shall be deemed failure of the examination.

3.8 CRITERIA AND METHODOLOGY FOR EXAMINING TECHNICAL STAFF EVALUATING INSTALLATION DOCUMENTS

Task - Assess the following aspects of the Installation Document related to:

A. Site Product Storage and Handling - The method of storage and handling products to their erection/installation must be reviewed for adequacy. The method of weatherproofing products to be stored outside, the means of transporting products from the storage area to the building, and the ongoing means of re-checking the product's integrity during storage and handling must be checked.

B. Erection/Installation - Methods of erecting and/or installating the product in the building, including equipment, personnel, etc., must be reviewed. Special attention must be paid to safety during erection.

C. Occupancy Completion - Items requiring completion prior to occupany and issuance of any certificate of occupancy must be assessed.

Using:

A. Installation Drawings - Drawings detailing the various steps of installation of the unit.

B. Specifications - More complete specifications than those approved under the Product Description Document are used in this review.

C. Inspection Manual - The inspection manual detailing the required inspections for installation of the product.

D. Field Test - Field test schedule for tests required by the particular design and specified codes and standards.

Requirements -

A. Ability to Read and Interpret Construction Drawings - Understanding of such drawings, specifications, inspection manuals, etc., and ability to evaluate their sufficiency.

B. Understanding of Site Construction Procedures.

C. Familiarity with Required Field Tests - Knowledge of code-required tests and how they fit into the construction procedures and schedule.

D. Ability to Anticipate Modes of Failure - The construction process design perception providing the evaluator with an understanding of where materials and products undergoing field construction processes may fail. This may involve structural design perception to anticipate structural failure during erection.

Criteria -

A. Education -

1. High school or equivalent.
2. Degree in engineering may be required in some cases.

B. Experience - Five years of construction experience

in a supervisory position.

C. Ability - Adequate performance on an examination related to the requirements.

Methodology -

A. Education - Shall be verified by certified proof of graduation or other written confirmation.

B. Experience - Shall be verified by submission of a detailed resume including a minimum of three references.

C. Examination - May be written or oral (before a board). The applicant shall answer adequately questions relating to each of the requirements. Failure on any one of the requirements shall be deemed failure of the examination.

PART 4 IDENTIFICATION OF CONCERNS AND ISSUES

CONTENTS

PART 4

This current study has focused attention on concerns and issues related to the regulation of industrialized building, some of which would benefit from further study and research and others which could be handled by the development of additional model rules and regulations. The following list is not arranged in any order of priority nor is it intended to be exhaustive.

4.1 EDUCATIONAL PROGRAM

Manufactured building regulation and its component activities of Analysis, Testing and Compliance Assurance are not subjects directly and fully covered by any current educational curriculum, whether professional, technical or vocational. Development of training programs for building officials at various levels could be based on the requirements, criteria and methodology that result from the standards-making process described in Section 1.1. It also could benefit from an extensive survey of current educational programs at both professional and vocational levels to find the applicable state-of-the-art. Such a program could have both immediate and long-range benefits, in terms of both staffing Analysis Agencies with capable personnel, and in the long run improving the Analysis function itself.

4.2 MANPOWER EVALUATION

If brought to reality, the proposed "National Board of Building System Evaluators" (See 3.1) would face the necessity for dealing with several issues of which only the key ones will be suggested here.

4.2.1 Education vs. Experience

The proposed criteria and methodology indicate education and experience required to carry out various activities. While these recommendations are firm in some areas and tentative in others, the entire issue of the tradeoff between education and experience is one which is open to question. This is endemic to the whole regulatory process and is exacerbated in manufactured building regulation because of its novelty.

Further study might delve into this issue in-depth, attempting to identify the separate parameters of building education and building experience as they relate to the specific activities of industrialized building regulation.

4.2.2 The Role of Professional Registration in Establishing Qualifications of Technical Personnel

Some current state registration laws for professional engineers and architects fall short of meeting the regulatory needs of manufactured building in one or more of five areas:

1. Non-uniformity of state laws and registration exams leading to

a lack of universal reciprocity of registrations. State registration laws and examinations which restrict their scope to the environmental requirements peculiar to the subject state, may preclude acceptance of professional registrations by reciprocity in states having more stringent environmental requirements. A manufacturer marketing buildings in a regional area may find his product inacceptable in states having greater environmental design requirements.

2. Limited scope of competency levels, covering only professional engineers and architects. The majority of work associated with building system evaluations of the prescriptive type are carried on today by sub-professional technicians not covered under professional registration laws. At the other end of the scale, certain specialist or "super-professional" engineers not included in current registration catagories may be needed to evaluate innovative building systems dealing with new materials or processes.

3. Limited scope of disciplines. Present registration examination practices do not recognize all of the necessary building system disciplines. Due to other purposes being served by the registration laws, the trend is in the opposite direction in some states, with registrants being recorded only as a "Professional Engineer," etc.

4. No evaluation of technical obsolescence. With few exceptions the state registration laws do not deal with the problem of technical obsolescence. In the assessment of current competance, particularly that needed for evaluating innovative manufactured building, a re-examination period or other procedure needs to be incorporated in order to maintain the viability of certification of individual technical competence.

5. Knowledge and use of building codes and standards is not assessed by most registration examinations for professional engineers.*

As has been pointed out, there is a need for specialty certification of building evaluation personnel on a regional or national basis, with a built-in mechanism for avoidance of technical obsolescence. The question needs to be resolved as to whether registration as a professional engineer by the several states can or should have a place in the objective assessment of technical competence to perform the specific building evaluation functions proposed in this report, or should simply be noted for the benefit of those states which may require registration for legal purposes. In addition, the time period before requiring re-examination or other updating assessment, needs to be established.

*California's written examination for registered Structural Engineer is one exception.

4.3 THE ROLE OF THE STATE

4.3.1 Accrediting Building Evaluation Agencies

Among the issues that need to be resolved is the role of the state in accrediting building evaluation (i.e., Analysis, Testing, Compliance Assurance) agencies. One possible approach is outlined in Appendix B "This Is LEAP" where it is suggested that the State Administrative Agency or its designee should conduct any non-technical investigations of applicant institutions, i.e., investigations which relate to business operations, independence of judgment, etc. However, since these attributes may be at least as important as technical competence, criteria and methodology should be developed for such non-technical examinations as a basis for objectivity and reciprocity of accreditations.

4.3.2 Assignment of Evaluation Jobs

Another issue concerns the states' roles in assigning particular accredited agencies to conduct specific building system evaluations. In this report, a straight forward, direct role is envisioned; see Reciprocity of Building Functions in Appendix B "This Is LEAP." In this approach the team lineup of agency(s) performing the Analysis, Testing and Compliance Assurance Functions on a specific job would be established by the state and would be made known to all interested parties from the outset. This approach allows the state any mix it chooses regarding the selection of governmental and private agencies for a particular team, with each participant meeting the criteria established as a basis for reciprocity.

4.3.3 Alternative Approval Methods for Building Systems

The earlier discussion of the Analysis function raised the issue of who actually issues the approval of a system found to be in compliance with the applicable code. This issue relates to the question of liability, and has both legal and administrative aspects.

While it is clear that the Analysis function can, and in many cases will, be carried out by a third party, the question is whether a state can actually delegate the actual approval function, or whether it must itself give approval based on third party recommendation. The answer may vary from state to state and may depend on each state's laws, or it may be uniform.

Laws should be surveyed to answer this legal question and the technical and administrative implications of the various alternatives should be explored in order to complete this rather specific, but multi-disciplined study.

In all of these considerations, a maximum degree of flexibility of approach is desirable among the states as to the minimum set of activities which must be carried out directly by the State Administrative Agency in order to fulfill its responsibilities. This is both a legal and political question.

4.4 COST AND FEES

The basis of the proposed Analysis function procedure is that it must be applicable to a broad range of product preassembly, to the full range of technological innovation, and to a variety of possible delivery processes. Clearly, the costs of carrying out the Analysis function will vary greatly depending on the characteristics of each particular submission within the possible range, as mentioned earlier. Under these circumstances, it is important that the fee structure imposed on applicants, on the building industry, and/or on society in general, reflect the variation in cost while being equitable.

A study of the Analysis function costs and the development of the proposed fee structures should follow on the comparison of several models which identify costs borne by society in general, costs borne by the building industry and costs borne by particular applicants.

4.5 LIABILITY

Liability was one of the areas of concern most often heard in the informal interviews carried out for the present study. Such questions as whether or not the liability imposed on third party evaluators for manufactured building causes a competitive disadvantage vis-a-vis conventional building were raised. Clearly, such questions suggest the delicate nature of the problem, since liability in manufactured building must be studied in the context of liability in building in general.

Thus, a study of liability is again a well-defined area where legal, economic and administrative factors meet and interact.

4.6 RESPONSIBILITY FOR INSPECTION IN-PLANT, IN-TRANSIT AND ON-SITE

The description of documents required for the Analysis function has covered the Compliance Assurance Manual and the Installation Document. Between them, they cover all the procedures and inspections necessary to assure the approved product's integrity throughout its delivery process, from supply of raw materials in the factory to installation of the building on the final building site. The Compliance Assurance Function is implemented in the plant by a third-party agency, which affixes a compliance label, and the Installation is implemented in the field by the local building official.

The question arises as to where lies the responsibility for procedures of inspection of the product in-transit to the site and what if any added responsibility does the state have where local citizens do not choose to support a code enforcement officer. If the label is affixed at the plant, who asserts that the product's integrity has not been impaired in transit? Where does the Compliance Assurance Agency sign-off on the product?

These questions are related to a similar set of questions as to who is responsible for inspection when the product involves an on-site factory, as do many concrete panel systems.

This brief discussion is sufficient to suggest that the border between Compliance Assurance and field inspection is rather fuzzy, if not entirely variable,as a function of specific materials, products, systems and processes.

The study of this subject must zero in on the detailed description of the total building process, analyze the specific characteristics of

plant activities, transportation activities, and site activities, and synthesize a model of enough breadth and generality to cover all the alternatives realistically possible in the building industry.

APPENDICES

CONTENTS

Appendix A

MONITORING AND AUDITING

1 - NEED FOR MONITORING

2 - ASPECTS OF MONITORING

3 - FREQUENCY OF MONITORING

4 - MONITORING PROCEDURES

Appendix A

MONITORING AND AUDITING

In the course of developing criteria and methodology for examining institutions, the role of the state in monitoring the performance of delegated building-evaluation functions was identified as an important factor. While it is beyond the scope of this report to consider the state's role in detail, various possibilities and opportunities for monitoring did evolve from the development of the criteria and methodology. They are summarized in this appendix for further consideration by NCSBCS and the individual states.

1 NEED FOR MONITORING

Analysis Agencies will be approved by the State Administrative Agency by applying the requirements, criteria and methodology described in the previous chapter. Such approval will last for a predetermined length of time, after which re-approval will be required. Among other factors in determining the re-approval will be the reports prepared as a result of ongoing monitoring by the Administrative Agency. In addition to determining the re-approval of a particular Analysis Agency, this monitoring will also serve as a basis for updating the requirements, criteria and methodology themselves. This latter aspect is desirable because of the empirical character of the requirements, criteria and methodology for certain aspects of the Analysis function (e.g., evaluation of performance specifications, evaluation of Compliance Assurance Manuals, etc.).

The requirements for monitoring the Analysis Agencies may also have a legal basis, as a condition of a state's delegating the Analysis function to a third party.

It is beyond the scope of this report to establish all the detailed activities and staffing of the monitoring function. Rather, based on the detailed description of the proposed Analysis function procedure, various monitoring possibilities and options will be identified.

2 ASPECTS OF MONITORING

Monitoring the Analysis function has two main aspects: financial and technical.

The financial aspect combines the assurance that no conflicts of interest occur and that fees are established consistently and collected equitably.

The technical aspect of monitoring concerns the assurance that an Analysis Agency is competent to carry out its assigned evaluation tasks, as well as to manage the entire Analysis function efficiently.

2.1 Conflicts of Interest

It is clear that an Analysis Agency must be an objective third party acting as an agent of the state. As such, the agency itself, and any members of its staff of consultants must not have any direct financial interest in the organization whose application is being considered. However, several other sources of potential conflict must be considered:

(1) Financial interest or other business relationships with an applicant's competition. Complete elimination of this source of conflict would imply disqualification of any person actively engaged in any aspect of industrialized building from working for or consulting to an Analysis Agency. This could be impractical as well as undesirable, for it could eliminate the use of highly expert professionals. Thus judgment must be exercised in eliminating this source of conflict of interest.

(2) Financial interest or other business relationship with any supplier of materials or services to the building industry. This is related to the source of conflict in (a) above, except that it related to the total building industry rather than to industrialized building. Should an interest in wood products, or in aluminium, for example, disqualify a person from evaluating a concrete building system? Here, too, judgment must be exercised.

(3) Any other professional participation in the building process. This source of conflict of interest is the hardest to grasp or to control, because it is mostly a question of attitude. To the extent that industrialized building represents innovation of both product and process in the building industry, it might be viewed as a threat to certain established ways of doing things. Specifically, it may be viewed by certain professionals as a threat to the future of their profession as they know it. Similar points have been raised in various discussions of institutional response to technological innovation generally, and it is not unique to building. Clearly, however, the expertise and experience required to carry out Analysis function activities reside in the very professions whose continued existence may be threatened (whether in fact or only in perception is irrelevant here). Here is where the most judgment is required, and no precise guidelines can be established. Perhaps the only thing that can be stated with certainty is that the evaluation of innovation requires people who are open to innovation.

(4) Another conflict of interest might involve an agency performing compliance assurance on a system it has evaluated. This could lead to a possible intentional covering of errors made in the evaluation.

While it might be possible to avoid entering into a situation with a specific conflict of interest, we should raise the further question

of whether a conflict is not generated by the very fact that the fee for the Analysis function may be paid in whole or in part by the applicant. While it is perhaps improper to call into question professional ethics, one must not lose sight of the extremely competitive nature of the building industry in general, and building professions in particular. It is conceivable that in a state with a rapidly growing industrialized building industry, several Analysis Agencies would be authorized to evaluate building systems. In such a case, even with fees established by law, cannot applicants engage in "approval shopping?" It is a question that will not be considered and cannot be solved here. Perhaps the state could undertake the assignment of each application to a specific Analysis Agency on a random or rotational basis, and by this means minimize the potential for developing such a conflict of interest.

2.2 Payment Methods and Fees

The proposed Analysis Function Procedure covers a broad range of product preassembly of technological innovation and of applicant participation in the building process. Thus, the Analysis Agency's scope of work may vary widely from one application to the next in terms of staffing, time and effort. It is clear that the Analysis Agency must be reimbursed in a manner commensurate with its efforts. Thus, a fee schedule must be developed.

Such a schedule will respond to each of the following parameters:

(1) The scope of the system (Is the proposed product a complete building, a subsystem, a component, etc.?)

(2) The degree of technological innovation (Is a performance specification to be proposed and evaluated?)

(3) The extent of applicant participation (Are all three documents; Product Description, Compliance Assurance, Installation, to be submitted and evaluated, or only one of them?)

The fee pertaining to a specific application can be determined at the preliminary meeting.

The question of methods of payment is one which relates to conflict of interest as well as to a variety of other legal and administrative issues. Its resolution is beyond the scope of this report, and this brief discussion is confined to a listing of several alternatives:

(1) All Analysis Agency fees can be paid by the applicant at the time of submission of documents.

(2) All fees can be paid by the state from its general tax revenues.

(3) All fees can be paid by the state from a variety of taxes imposed on the building industry in general.

(4) A basic fee can be paid by each applicant, and the difference between it and the total reimbursement can be made up by the state in either of the previous alternatives.

(5) The fees can be paid to the Administrative Agency, and in turn, to the Analysis Agency thus insulating the Analysis Agency from any direct financial dependency upon the applicant.

3 FREQUENCY OF MONITORING

The frequency of monitoring is related to the workload of the Analysis function or the number of applications being processed, to the length of time the Analysis Agency has been in operation and to the method of monitoring. A discussion of the latter point follows.

In principle, there are two distinct methods of monitoring. One method would select a particular application and monitor every phase of its processing through the Analysis function. This could be viewed as vertical monitoring. The other method would select and monitor specific points in the Analysis function procedure without regard to whether one or more applications were being covered. This could be called horizontal monitoring.

Each method has its advantages and disadvantages. Since the proposed Analysis function procedure is one which clearly stresses the need for a holistic approach to the regulation of industrialized building, the vertical monitoring might give a better picture of the operation of the total process. However, the Analysis Agency's knowledge that it is being monitored could spur it to a typical performance. Perhaps some combination of the two methods would be in order.

4 MONITORING PROCEDURES

The following is a brief discussion of possible monitoring procedures and where they occur in the proposed Analysis function procedure (see Attachment B).

4.1 Observations

Certain of the Analysis function procedures lend themselves to optional monitoring by the State through direct observation.

(1) Preliminary meeting is the first such activity, where the viability of the meeting itself, as well as its specific procedures and documents can be assessed.

(2) Check of submission adequacy and fee collection. This is a routine activity, and its smoothness of operation can be assessed.

(3) Selection of the evaluation team. Observe the management meetings called by the project leader to select the evaluation team. In this way, the viability of the project management approach to the Analysis function can be assessed.

(4) Evaluation activities. These will be related to the size of the document and will also involve staff meetings or individual efforts which can be monitored directly.

4.2 Review Documents, Correspondence, Reports

This procedure involves the review of the output of the various Analysis function activities.

(1) Control Document. This is produced by the preliminary meeting and can be assessed as to its effectiveness in providing a framework for the entire Analysis function procedure.

(2) Staff Selection Documents. Any documents used by the project leader for staff selection (e.g., management plans, schedules, manpower loadings) may be reviewed for usefulness and effectiveness.

(3) Document Evaluation. Documents and forms used in the document evaluation (for recording, rating, requesting additional information, etc.) can be evaluated.

(4) Notations of Communications. Any notations or communications from the Analysis Agency to either the Compliance Assurance Agency or to the local building official may be reviewed.

(5) General Correspondence. All correspondence between the Analysis Agency and the applicant may be reviewed for clarity, purpose, and usefulness.

4.3 Meet with Participants

These meetings, with participants in the Analysis function procedures, are carried out individually, and are designed to elicit less formal, possibly more candid reactions to the procedure. The following meetings may be useful:

(1) With applicant and his consultants - to obtain their opinions on the effectiveness of the procedure in presenting the fewest constraints to the development and building processes.

(2) With Analysis Agency staff and consultants - to obtain their opinions on technical and administrative aspects of the procedure, as well as on the project management approach.

(3) With Analysis Agency management - to obtain their opinion on the efficiency of operation, on fee structure, and on staffing.

(4) With Compliance Assurance Agencies - to obtain specific information on the effectiveness of compliance assurance programs approved by the Analysis Agency.

(5) With inspection agencies or local building officials - to obtain specific information on the effectiveness of field inspection procedures approved by the Analysis Agency.

Appendix B

THIS IS LEAP.

The sample brochure "This Is LEAP" was prepared by the Center for Building Technology, National Bureau of Standards, for the National Conference of States on Building Codes and Standards (NCSBCS). The context of the brochure is that the State Administrative Agency is answering a request for information from an interested party regarding the Laboratory Evaluation and Accreditation Program (LEAP).

This is a revised version of the brochure under the same title, dated November 1971, which is included in the Project LEAP document "Methodology for Examining Testing Laboratories," June 1972.

THIS IS LEAP*

Revised April, 1973

Administrative Agency

State of _____

*Laboratory Evaluation and Accreditation Program

INTRODUCTION

The State Manufactured Building Act provides for establishment of an Administrative Agency to implement rules and regulations for manufactured building. In carrying out its responsibilities for evaluating and approving manufactured building systems, the Administrative Agency may utilize the services and facilities of public or independent, private institutions.

To establish credence in and to facilitate intra- and interstate reciprocity among building system evaluations made through use of either public or private institutions, the Administrative Agency plans to initiate an accreditation program for such institutions.

For State accreditation purposes these building-evaluation services are divided into three functions: analysis, testing and compliance assurance. These functional terms are defined as follows:

(1) Analysis is the building-evaluation process which includes analytical examination and review of design and test documents using professional judgment and experience, to determine whether a proposed manufactured building or component conforms to applicable codes and standards.

(2) Testing is the building-evaluation process whereby the engineering properties claimed for manufactured building or components are validated by using appropriate standard test methods or other approved physical simulations based on recognized engineering principles.

(3) Compliance Assurance is the building-evaluation process of appraising the manufacturer's compliance control program, in conjunction with full-time or periodic monitoring, surveillance or audit, implemented to provide objective evidence that manufactured buildings or components conform to the approved documents.

Note: 1. Compliance Assurance relates to the Inspection Agency function as defined in the Manufactured Building Act, and has also been variously referred to as Quality Analysis and Quality Control. The Compliance Assurance Manual is prepared and the program implemented by the Compliance Assurance function and approved by the Analysis Function under the Manufactured Building Act.

2. Compliance Control Program is the manufacturer's system, including directly related quality and process controls, for assuring compliance with applicable codes and standards. The Compliance Control Document is prepared and the program implemented by the manufacturer and approved by the Compliance Assurance Function. The Compliance Document is incorporated into the Compliance Assurance Manual.

3. Agency, designates the accredited or approved status of an institution to act as an agent of the state in the regulation of manufactured

building. (e.g., Analysis Agency performs the Analysis Function.)

A program, hereafter referred to as LEAP (Laboratory Evaluation and Accreditation Program), has been instituted under the rules and regulations of the Manufactured Building Act. Under this program, interested institutions may apply for accreditation to provide services and facilities covering any or all of the three building-evaluation functions.

WHAT DOES IT ALL MEAN?

FOR THE BUILDING-EVALUATION INSTITUTIONS -- Accreditation by the State Administrative Agency means that the work of the building-evaluation institution will be accepted by the Administrative Agency whether or not the manufacturer or the institution itself is located within the borders of this state.

FOR THE MANUFACTURER -- The LEAP Project is designed to assure equitable evaluation of manufactured building, products or techniques, including those of an innovative nature.

FOR THE CITIZEN -- The LEAP Project is one of the key elements needed to assure that building components, fabricated and assembled through an industrialized process, will be subjected to inspections equivalent to those given to on-site constructions.

FOR THE STATE -- The LEAP Project enables the Administrative Agency to summon the best combination of government and privately-owned technical resources to the task of evaluating the design of proposed manufactured building systems or components and of certifying

conformance of production units with approved building system documentation by providing follow-up, compliance monitoring services. The LEAP Project also opens the door for government building-evaluation departments to request accreditation by the Administrative Agency. The credibility established by accreditation is intended to be the basis for interstate reciprocity of manufactured building certification programs, thus making possible the economics of large scale production.

INSTITUTIONAL ACCREDITATION

The accreditation "teams" lineup and relationships are illustrated in Figure 1. A summary of the functions and responsibilities of each member of the team follows.

STATE MANUFACTURED BUILDING ACT

Authority for the LEAP Project stems from the State Manufactured Building Act. Basic elements of the Rules and Regulations promulgated under the authority of this act include:

- Objectives and scope
- Establishment of a State Administrative Agency
- Authority to designate accredited Analysis, Testing and Compliance Assurance Agencies and recognize those of other states.
- Adoption of nationally recognized consensus building standards(s).
- Establishment of an Appeals Procedure.

ADMINISTRATIVE AGENCY

The State Administrative Agency is charged in part with statutory responsibility for approving building-evaluation institutions. Functions of the Administrative Agency or it's designee include:

INSTITUTIONAL EVALUATION AND ACCREDITATION

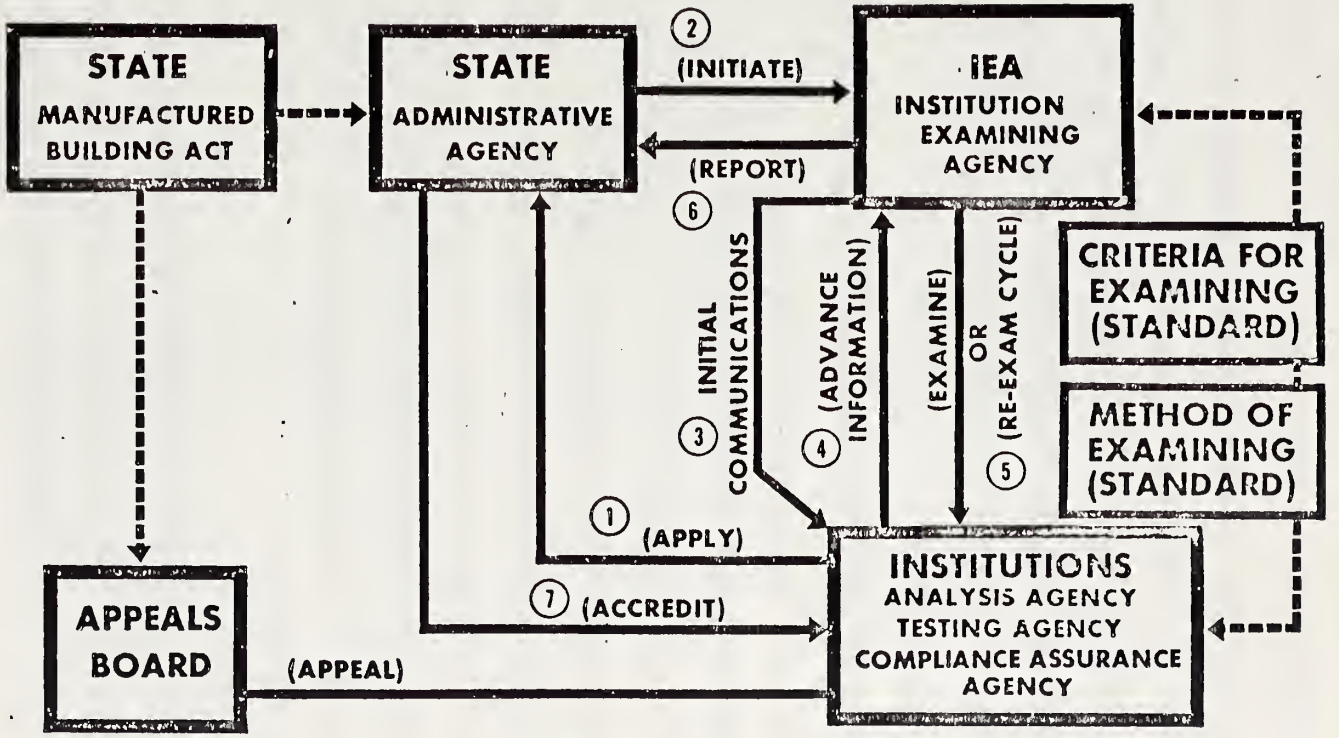

Figure 1

- Answers requests for institutional accreditation.
- Initiates the processing of an accreditation request by employing a designated examining agency, utilizing nationally recognized standard criteria and methodology.
- Investigates non-technical aspects of an applicant's operations, such as finance, corporate relationships, credit, insurance, business reputation, objectivity and independence.
- Accepts a report from the examining agency covering the applicant's capability to do the required work.
- Grants or denies initial accreditation based on results of it's own investigation of the institution operations and the examination of technical capability.
- Withdraws accreditation, for cause, based on follow-up reports on agency operations or technical performance, or the results of the regular, periodic re-examinations specified in the Rules and Regulations for the Manufactured Building Act.

Information gathered by the Administrative Agency or it's designee, and by the examining agency, is considered proprietary and will be handled as provided by the rules and regulations.

INSTITUTION
EXAMINING
AGENCY

The Institution Examining Agency (IEA) is designated by the Administrative Agency to determine the capability of applicant institutions to perform tests, analyses or monitor compliance control programs conducted under the Rules and Regulations. The agency is composed of examiners skilled in the respective building system disciplines.

The standard for examining institutions[1] provides the criteria and methodology for IEA's examination of an applicant building-evaluation institution. Cost of the examination is borne by the applicant. The examination itself is composed of three parts:

- Review of advance information on technical resources furnished by the applicant upon request of IEA.
- On-site examination of administrative procedures and technical resources including procedures for conducting required tests, analyses or compliance assurance tasks.
- Submission of a report of findings by the IEA to the Administrative Agency or it's designee.

While the examining agency operates at the convenience of the state, the agency is staffed and supervised by an independent,

[1]Development of the standards to be used by the examining agency was begun in August 1972 by ASTM Committee E-32.

nationally-recognized organization and functions neither as an arm of state government nor as a commercial or public analysis, testing or Compliance Assurance Agency (See "Institutions" below).

INSTITUTIONS
  ANALYSIS AGENCY
  TESTING AGENCY
  COMPLIANCE ASSURANCE AGENCY

The term "Institution" is used here to describe organizations applying for accreditation to serve as agents of the state in performing any one or a combination of the three building-evaluation functions. Applicants may include public or private, profit or non-profit institutions. Organization and functions of the state and the building system producer, are briefly summarized in "Interagency Relationships" below. These relationships are defined in greater detail in the standard criteria and methodology.[2]

An institution having the appropriate competence may apply for accreditation in any or all three of the above building-evaluation functions. However, the institution will be examined for competence using separate criteria for each of the functional areas requested. Continuation of the accredited status of an agency is contingent on successful re-examinations, which are periodically conducted in accordance with the Rules and Regulations for the Manufactured Building Act.

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[2] Ibid.

Test Agencies only are specifically accredited in one or more of the following building-system diciplines. The Analysis Agency is accredited only if it has access to all of the building-system diciplines. Accreditation by building-system discipline is considered to be unnecessary for the Compliance Assurance Agency.

- Electrical
- Fire Safety
- Mechanical (HVAC)
- Plumbing
- Structural

CRITERIA FOR EXAMINING (STANDARD)

METHOD OF EXAMINING (STANDARD)

The standards used in the examination of institutions provide the criteria and procedures used by the IEA in examining the capability of a particular applicant. IEA examines the applicant's stated capability to analyze, test, or provide compliance assurance services with reference to nationally accepted building standards adopted under the Rules and Regulations. As discussed under "Institutions," the standard provides that a qualified applicant may apply for state accreditation to perform services covering any one or all three of the building-evaluation functions.

APPEALS
BOARD

If the institution believes that improper interpretation or application of the Rules and Regulations by the Administrative Agency or it's designee has caused the denial of accreditation or the withdrawal of previous accreditation, the institution has recourse. The Rules and Regulations include an appeals procedure and the establishment of an objective appeals board.

RECIPROCITY OF BUILDING EVALUATIONS

The previous section describes how interested government or private institutions may become accredited to act as agents of the State Administrative Agency. If the Administrative Agency finds that the standards for the fabrication and evaluation of manufactured buildings or building components prescribed by statute or rules and regulations of another State, or other governmental agency, meet the objectives of the Manufactured Building Act, the Rules and Regulations provide that the Administrative Agency shall accept manufactured buildings or building components which have been certified by such other State or governmental agency, and shall assure that the appropriate label is attached thereto. Reciprocity is extended by the Administrative Agency by:

(1) Notifying the requesting manufacturers;

(2) Notifying the Administrative Agency of the other jurisdiction;

(3) Publishing a notice of the grant of reciprocity in [3]

(4) Giving notice to all local enforcement agencies in this State.

Figure 2 illustrates the process of reciprocal certification of building evaluations. The manufacturer submits a request for approval to the Administrative Agency of State "A" (Step 1). Depending on workload and organizational accredited arrangement, the Administrative Agency assigns the work to its own accredited government Analysis Agency or to an independant, accredited Analysis Agency (Step 2). The state will also select accredited Compliance Assurance and Test Agencies to participate in appropriate phases of the building-evaluation process.

The assigned Analysis Agency then carries the project through to approval. Submittal of documents and communications takes place directly between the manufacturer and the Analysis Agency (Step 3). Approved sets of documentation are sent to the manufacturer and to the Administrative Agency of State "A" (Step 4).

Subsequently, the manufacturer from a jurisdiction to which reciprocity has been extended may submit to the Administrative Agency of this state evidence that his building system and

[3] Insert name of journal designated by State for publication of legal notices.

RECIPROCITY OF BUILDING EVALUATIONS

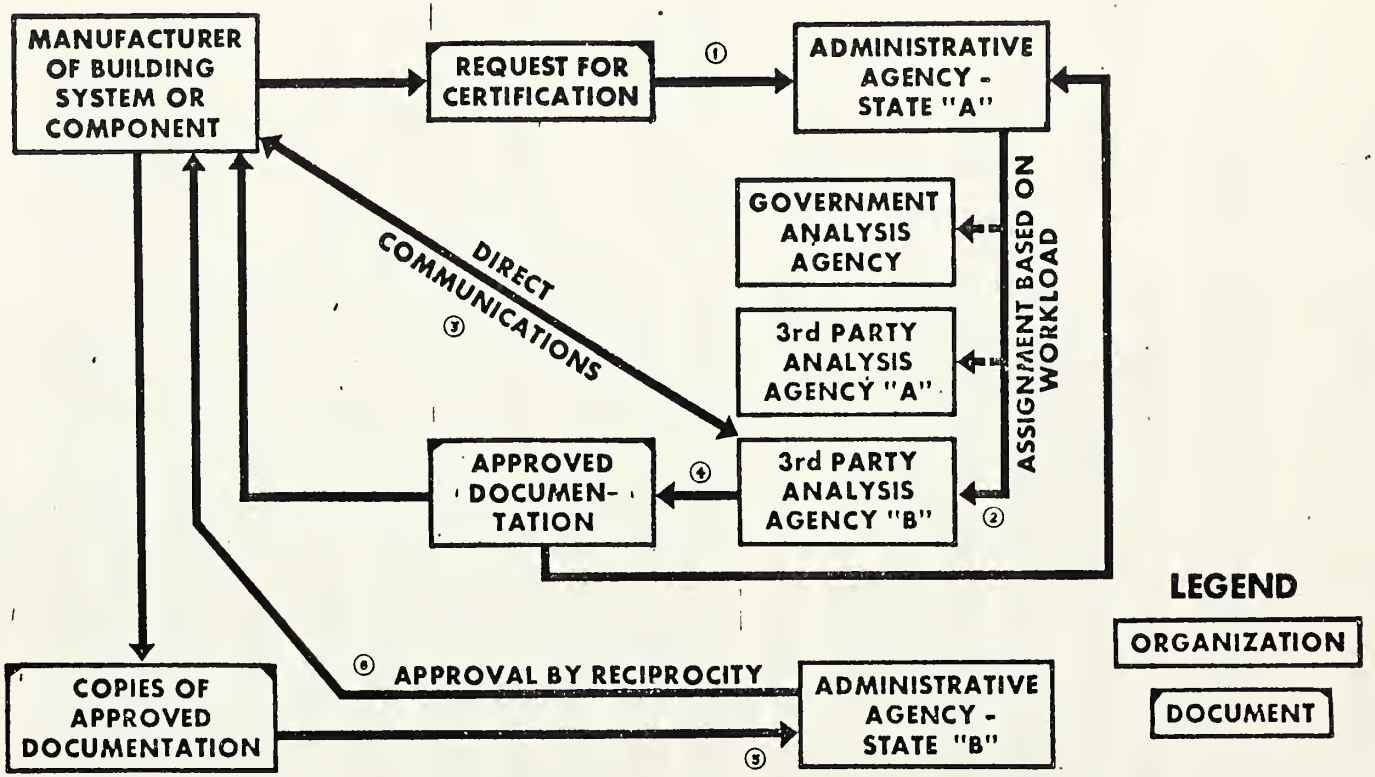

Figure 2

pliance assurance program have been approved by such state or governmental agency. The Administrative Agency then verifies the approval and notifies the manufacturer in writing of such verification and that properly labeled buildings or building components of his manufacture will be accepted.

INTERAGENCY RELATIONSHIPS

A system has been described of recognizing the capability and work of building-evaluation institutions and of achieving reciprocity of building evaluations among the states. One manner in which these agencies might work together to approve and certify a particular building system is illustrated in Figure 3. After the work has been assigned by the Administrative Agency, the scope of effort is defined in a meeting between the manufacturer and the Analysis Agency. The subsequent submittal of required building system documentation and all related communications take place directly between the Analysis Agency project manager and the manufacturer until the project is approved, is abandoned or is under appeal (Step 1).

If it is not possible to approve the building system through analytical means alone, a Testing Agency may be required to perform supporting tests. The resulting test reports then become part of the submittal documentation. (Step 2 - optional.)

In order to grant full approval of a proposed building system, the Analysis Agency must approve three documents; the

INTERAGENCY RELATIONSHIPS

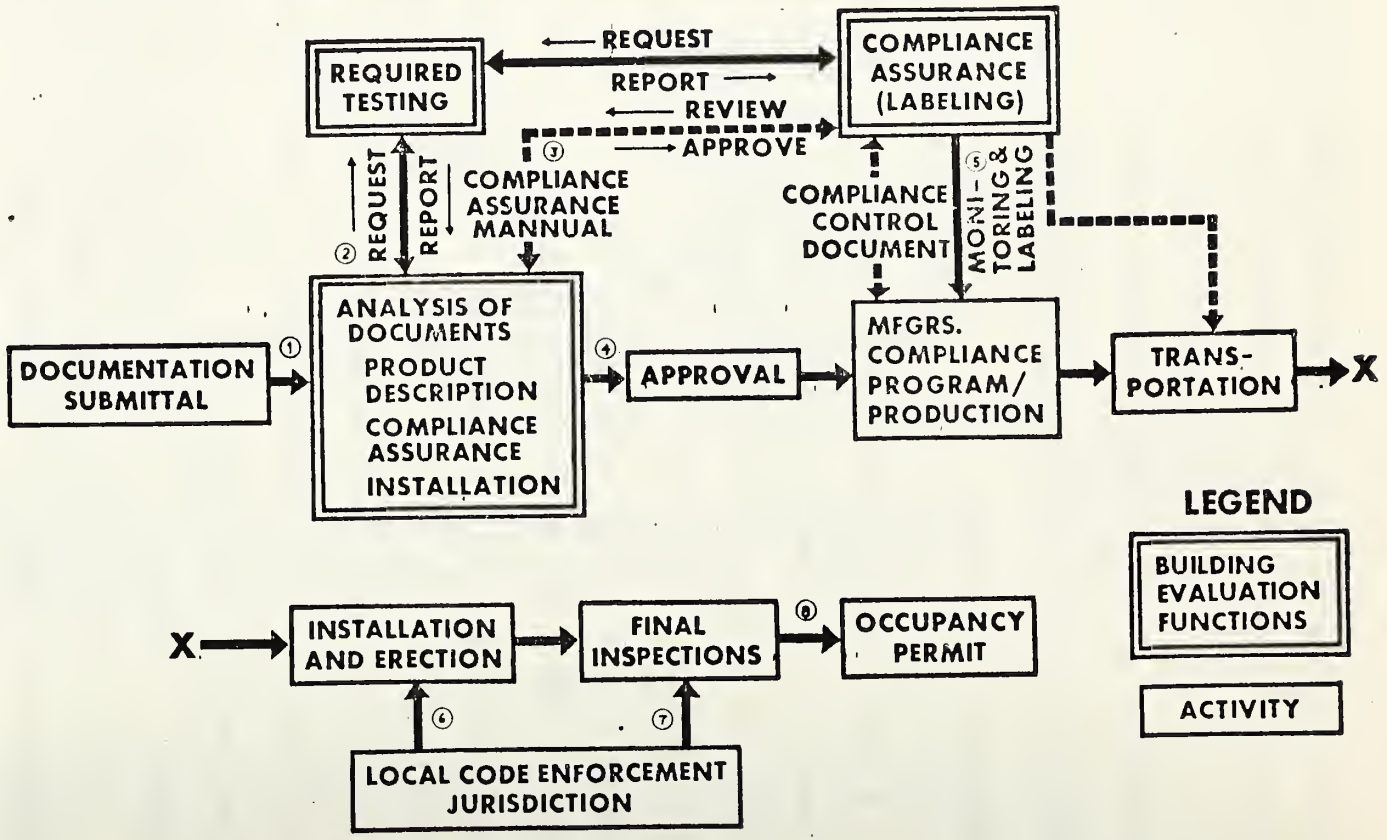

Figure 3

Product Description, Compliance Assurance and Installation Documents. Submittal of these documents may be made at one time or in phases, at the discretion of the manufacturer.

Preparation and submission of the Product Description and Installation Documents are the responsibilities of the manufacturer. To assure completeness as well as effective implementation during the production phase, the Compliance Assurance Agency designated by the Administrative Agency reviews the manufacturer's Compliance Control Document for preliminary approval. (Step 3.) The approved Compliance Control Document is then incorporated by reference as part of the Compliance Assurance Manual, which is submitted to the Analysis Agency for overall approval.

When the building system is approved and goes into production (Step 4), the Compliance Assurance Agency continously monitors the effectiveness of the manufacturer's Compliance Control Program and may be designated to control the product certification labels issued by the Administrative Agency (Step 5).[4]

If, after production commences, significant tests are necessary which (a) require the issuance of a full test report and (b) are necessary to demonstrate equivalency of substitute materials or processes or the correction of a defective process, such work is performed by the Testing Agency at the request of the Compliance Assurance Agency or Analysis Agency.

[4] Details regarding the monitoring of the transportation function are not included in this brochure.

The local code enforcement jurisdiction provides inspection services during the Installation (Step 6) and Final Inspection Activities (Step 7), and issues the Occupancy Permit (Step 8).

By building-in a high degree of flexibility for the method of application, the type of process suggested in Figure 3 can accommodate a broad scope of products ranging from wall panels to complete buildings, whether prescriptive or innovative in nature, while providing the necessary assurance of compliance with applicable codes and standards.

NEED MORE INFORMATION?

If you want additional information or you desire to apply for accreditation, contact:

Administrative Agency
State of _____
_____, _____
Phone _____

Appendix C

GENERAL INFORMATION FOR INSTITUTIONS APPLYING FOR ACCREDITATION AS ANALYSIS AGENCIES UNDER THE MODEL MANUFACTURED BUILDING ACT

The first step in examining the technical resources of an applicant institution is the Advance Information Phase. This consists of a review of information provided on the application form and attachments. To assist the applicant in interpreting the application form, an information sheet is furnished with the form. A suggested information sheet is provided in this Appendix, directed to the informational needs of the applicant.

GENERAL INFORMATION FOR INSTITUTIONS APPLYING FOR ACCREDITATION AS ANALYSIS AGENCIES UNDER THE MODEL MANUFACTURED BUILDING ACT

It is the purpose of this information sheet to assist you in interpreting the application requirements for technical resource examination under the LEAP[1] Program for manufactured building. The discussion that follows pertains to three documents:

- Form for making application to State Administrative Agency for accreditation
- Standard criteria for examining Analysis Agencies
- Applicable building standards

A thorough understanding of the applicable building standards and the standard examining criteria will be necessary in order to successfully complete the applications.

You have indicated interest in accreditation as an Analysis Agency, to provide services and facilities for evaluating manufactured building systems and components. Definitions describing the building evaluation functions of Analysis, Testing and Compliance Assurance are given in the brochure "This Is LEAP." Note that an institution applying for accreditation as an Analysis Agency must have direct access (i.e. full time staff or established contractural relationships) to technical personnel in all of the following building system disciplines:

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[1]Laboratory Evaluation and Accredition Program

- Acoustics
- Architectural - Health and Safety
- Electrical
- Fire Safety
- Mechanical (Heating, Ventilating and Air Conditioning)
- Plumbing
- Structural

The Institutional Examining Agency[2] will collect data on your organization's technical resources and technical competence. The examining agency will submit this data to the State Administrative Agency for evaluation along with certain other information gathered by the state.

The technical resource examination conducted by the examining agency consists of two parts:

- Advance written and graphic information supplied to this office by your organization, as indicated on the application form.
- An on-site visit by an examiner to inspect facilities to verify advance information regarding technical competance of personnel.

The application form includes several questions regarding the willingness of the applicant to allow the examiner to do his job in a specific way. For example, a "no" answer to question

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[2]See Appendix B "This Is LEAP" for details.

(14) under General Information, or to question (4) under Related Analysis Experience, may result in rejection of the application.

In order to qualify as an Analysis Agency it will be necessary to show in-house capability to provide analysis services and facilities for all of the building system disciplines. However, the Administrative Agency may, under certain circumstances, permit a small part of the required building system disciplines to be subcontracted, or a pool of backup personnel to be maintained under contract to assist key personnel in performing jobs of large scope. Conditions for granting such exceptions will include, but not be limited to the following:

1) The percentage of the total required building system disciplines to be subcontracted must be less than approximately[3] _____%.
2) The prime Analysis Agency assumes full responsibility for work done by the subcontractor.
3) The subcontractor is examined for technical competance by the examining agency, and is approved as an individual only (See 3.1). Note: The subcontractor will not be independently accredited as an Analysis Agency.
4) A full description of the building-system evaluations to be subcontracted and a copy of the contractural provisions are furnished by the candidate prime Analysis Agency and approved by the State Administrative Agency.

[3]Percentage figure to be established by NCSBCS.

5) Once accredited, the prime Analysis Agency agrees to maintain the approved contract in force with the subcontractor until the prime Agency requests and receives approval for different subcontract arrangements from the State Administrative Agency. Failure to comply with this requirement may subject the prime Analysis Agency to immediate revocation of accreditation.

A schedule for the on-site examination will be proposed by the examining agency, subject to approval by the applicant, after the completed applications have been received and accepted.

Please send completed forms to: _____

_____

_____

Appendix D

APPLICATION FORM FOR INSTITUTION APPLYING TO STATE ADMINISTRATIVE AGENCY FOR ACCREDITATION UNDER THE MODEL MANUFACTURED BUILDING ACT

This appendix contains a suggested application form to be filled out by applicant institutions desiring to be examined for accreditation as Analysis Agencies. Advance information supplied on this form is reviewed by the Institutional Examining Agency to establish that the applicant meets basic requirements of the standard criteria, before an on-site examination is conducted.

APPLICATION FORM FOR INSTITUTION APPLYING

TO STATE (ADMINISTRATIVE AGENCY) FOR

ACCREDITATION UNDER THE (MANUFACTURED BUILDING ACT)

Except as otherwise authorized by the applicant, information furnished in this application and in the subsequent on-site examination will be employed by the Institutional Examining Agency and the cognizant State Administrative Agencies solely for the purposes of establishing accreditation of the applicant.

GENERAL INFORMATION

1. Name of the applicant institution _____

2. Name and address of parent or affiliate organizaiton

_____

3. Location of facilities _____

4. Mailing address _____

(City) (State) (Zip Code)

5. Chief Executive Name _____

Title _____

Telephone _____

(Area Code) (Number)

6. Indicate the category of Analysis function (prescriptive, innovative) for which your institution claims competance and seeks accreditation.

7. List the building standards for which your institution claims competence to perform the Analysis function.

8. List each in-house building-system discipline for which you claim

competence in performing the Analysis function. Note: Select from the following list: Acoustics, Architecture - Health and Safety, Electrical, Fire Safety, Mechanical (Heating, Ventilation and Air Conditioning), Plumbing, Structures.

9. List agencies from which your institution has received approval or accreditation.

Agency	Type of Approval	Effective Period	
		From	To

10. Institutional affiliations with technical or professional organizations _____

11. Describe the scope of services provided by your institution and years experience. Briefly outline the institution's objectives regarding future scope and type of services.

12. Attach a brief description of the methods and procedures used by your institution to establish when specific individuals have attained the necessary competence.

    a) To supervise the Analysis function of a building-system evaluation.

    b) To conduct the Analysis function of a building-system evaluation.

13. Institution Liaison[4]

Name _____

Title _____

Telephone _____

(Area Code) (Number)

14. Has the institution liaison thoroughly reviewed the LEAP Criteria and clarified all questions that he may have had regarding the indicated requirements?

YES _____ NO _____

15. Do you authorize the examiner to photograph pertinent facilities in your institution?

YES _____ NO _____

[4]This is the staff member or officer of your institution who will coordinate the institution's preparation of and participation in the examination program.

RELATED ANALYSIS EXPERIENCE

1. List building-system evaluations conducted by your institution during the last five years which are closely related (see Methodology 3.3-F) to evaluations required by the building standards for which competence is claimed.

Analysis Function Performed	Product Analyzed	Product Manufacturer	Analysis Performed for Whom	Year

2. Attach typical examples of recent Analysis reports whose format and scope are typical of that proposed for use.

3. List recent analysis experiences not necessarily related to the applicable standards but which you believe are indicative of your institution's capability to analyze building systems or sub-systems. Attach typical reports.

Analysis Function Performed	Product Analyzed	Product Manufacturer	Analysis Performed for Whom	Year

4. Do you authorize the Institutional Examining Agency to contact producers and customers identified in this application in order to check references?

YES _____ NO _____

5. Has your institution been the defendant in a lawsuit within the last five years wherein technical competence in evaluating building systems, subsystems or components was at issue: YES _____ NO _____. If the answer is yes, provide all pertinent details including current status.

6. Within the last five years, has your institution lost any accreditation conferred by a state, county, or city government jurisdiction or by an independent accreditation association? YES _____ NO _____. If the answer is yes, provide all pertinent details including current status. _____

_____
_____
_____
_____
_____

PERSONNEL

1. Attach a current organization chart indicating lines of authority in your organization.

2. Attach a list of all full-time, and consulting personnel engaged in supervision, operations or technical support activities.

Name	Position Held (Responsibility)	Employment Status (Check One)			Responsible For Which Building System Discipline	
		Full-Time	Part-Time	Contract	As Technician	As Engineer

3. Attach resumes for each person listed above. Resumes should be limited to one typewritten page and should relate to the Criteria specified for the prescriptive or innovative category selected under

Item 6 General Information. Include the name and a brief summary of education, training, experience, pertinent technical society or consensus standard affiliations, and pertinent publications. Where applicable, list pertinent licenses or registrations, including the certificate number and authority.

FACILITIES

1. Attach a sketch of your office and work areas. Include all pertinent information related to the basic requirements for the Analysis Agency as given in the Criteria.
2. Attach a list of pertinent technical and standard references which are contained in your reference library (Ref. Criteria), including edition and year.

ANALYSIS PROCEDURES

1. Does your institution employ standard written procedures for conducting building-system or component evaluations?

   YES _____ NO _____

2. If yes, approximately what percentage of the Analysis functions required in the Criteria are presently covered by written procedures? _____%
3. Please attach a representative copy of one of your more detailed Analysis procedures.

SUBCONTRACTORS

1. List any of the disciplinary areas required by the Criteria for the Analysis function, which will be performed by a subcontractor.
2. List any of the Analysis functions required by the Criteria for the Analysis function, which will be performed by a subcontractor.

   NOTE: If any (discipline) (Analysis function) is to be subcontracted, proceed to the following items.

3. Attach a copy of the contract between your institution and the subcontractor(s).
4. For a subcontracted analysis function only, a separate application form and attachments must be completed by the subcontactor(s). in the same manner and to the same degree of completeness as required for your primary application.
5. Will your institution be responsible for timely scheduling of an on-site examination visit to a subcontractor performing an analysis function?

   YES _____ NO _____

OWNERSHIP

1. Does your institution have legal ownership of all the facilities which you have listed in the application?

   YES _____ NO _____

2. If the answer to item (1) is no, identify the items not owned, describe the terms of usage and identify the lessor/loaner.

CONFIRMATION

The information contained on this application and its attachments has been reviewed by me and it is true to the best of my knowledge.

Signature of Chief Officer of applicant institution

Date

Notary Public

Date

Seal

Appendix E

LIST OF ORGANIZATIONS SUPPLYING INFORMATION FOR THIS STUDY

In conducting it's study of the Analysis function for Project LEAP, B. A. Berkus Associates contacted a variety of building evaluating agencies and building-system or component manufacturers. A listing of the evaluation agencies contacted is given in paragraph 1. The manufacturers contacted are listed in paragraph 2.

LIST OF ORGANIZATIONS SUPPLYING INFORMATION

1 EVALUATING AGENCIES

Building Officials and Code Administrators International, Inc., Chicago, Illino

Underwriters' Laboratories, Inc., Northbrook, Illinois

City of Chicago, Illinois

Glendon Mayo, Hartford, Connecticut

United States Testing Corp., Hoboken, New Jersey

City of New York, New York

Heery & Heery, Atlanta, Georgia

City of Atlanta, Georgia

International Conference of Building Officials, Whittier, California

City of Los Angeles, California

Pittsburgh Testing Laboratory, Pittsburgh, Pennsylvania

Department of Housing & Urban Development - FHA, Washington, D. C.

County of Los Angeles, California

LIST OF ORGANIZATIONS SUPPLYING INFORMATION

2 MANUFACTURERS

Zimco Homes, Pompano Beach, Florida

Davenport Homes, Largo, Florida

Perry Building Systems, Riviera Beach, Florida

Building Systems Development Corp., San Francisco, California

Descon-Concordia Systems, Ltd., Montreal, Canada

Phil Bobrow, Montreal, Canada

Omni Housing Systems, Inc., Santa Anna, California

Gypsum Association, Chicago, Illinois

H. B. Zachry Co., San Antonio, Texas

Owens - Corning Fiberglas Corporation, Toledo, Ohio

American Plywood Association, Tacoma, Washington

Appendix F

INTERVIEW CHECKLIST

Checklists were used in an informal manner to guide interviews conducted by B. A. Berkus Associates under Project LEAP Contract No. 2-35943. The checklist used for interviewing evaluating agencies is included under Section 1. The checklist for interviewing architects, engineers, industrialized housing manufacturers and building materials associations, is given in Section 2.

INTERVIEW CHECKLISTS

1 CHECKLIST FOR EVALUATING AGENCIES

PROJECT L E A P NAME: _____

CONTRACT #2-35943 DATE: _____

CHECKLIST FOR EVALUATING AGENCIES

I. ORGANIZATION & PERSONNEL

A. 1. Do you have a current organizational chart of your agency?

2. What type of ownership?

B. 1. What is total number of personnel?

- Professional?
- Technical?
- Managerial?
- Support?

2. What is the breakdown of personnel into disciplines?

- Architectural?
- Structural?
- Mechanical?
- Plumbing?
- Electrical?
- Acoustical?
- Legal?
- Quality Assurance?
- Fire Safety?
- Other?

3. Indicate experiences, education and registrations for your personnel in the above disciplines. [Get company's qualifications brochure.] Look for other qualifications such as trade experience.

II. INFORMATION

A. 1. Can you explain, or do you have a chart explaining the flow of information through your organization (applications, approvals, backup)?

2. What are all the alternative entry points for information into your organization?

B. 1. What information formats are required for applications?

- Drawings?
- Plans?
- Sections?
- Elevations?
- Details?
- Shop Drawings?
- Schedules?
- Specifications?
- Other written descriptions?
- Test reports?
- Management plans?
- Other?

2. Are these information formats the same for industrialized housing and conventional construction? If not, what is the difference?

3. What codes, criteria and other technical information do you use for plan evaluation?

C. What forms, if any, do you use for processing information? Is there a code reference for each item?

- Checking?
- Permits?
- Approvals?
- Other?

III. INNOVATIONS

A. 1. Do you approve new assemblies, products or materials?

2. If you do, are applications for such approvals handled by your regular organization or by a research bureau?

3. How do you establish criteria for approval of products using materials not qualified under current codes or standards?

B. 1. Have you any experience with approvals or industrialized housing?

What percentage of your total approvals?

2. Has your experience with industrialized housing covered frame systems, panel systems and modular (3-dimensional) systems?

3. Do you use a uniform method of processing industrialized housing applications of any level of preassembly?

4. Do you approve components conditionally when they form parts of larger assemblies?

5. Do you have a method for approving alternative options of a single model or system based on climate, site and/or consumer variables?

C. 1. Do you give approvals to prototypes of industrialized housing systems, which recognize their future change or evalution?

2. Have you any experience in expediting the approvals of an industrialized housing system by any kind of "on-board" reviews and approvals?

D. 1. Do you allow the substitution of testing documentation for evaluation?

How?

2. If so, how are the tests specified?

By you?

By manufacturer?

3. What relation, if any, do you have with testing laboratories?

E. 1. What is your experience with performance criteria and performance testing?

IV. COMPLIANCE ASSURANCE

A. Do you require the submission of compliance assurance programs as part of your normal approval mechanism?

B. Do you require the submission of compliance assurance programs as part of your approval of industrialized housing systems?

C. Are your approvals of industrialized housing systems conditional on the implementation of specific compliance assurance programs and inspections?

D. Do you issue directives to local inspectors regarding approved systems?

Are there standards for workmanship?

V. CHANGES

A. How do you handle changes in products or systems which have been approved?

VI. SEALED DOCUMENTS

A. Is a registered architect or engineer required to seal documents for approval?

2 CHECKLIST FOR ARCHITECTS, ENGINEERS, INDUSTRIALIZED HOUSING MANUFACTURERS AND BUILDING MATERIALS ASSOCIATIONS

PROJECT L E A P

CONTRACT #2-35943

NAME: _____

DATE: _____

CHECKLIST FOR A/Es, INDUSTRIALIZED HOUSING MANUFACTURERS AND BUILDING MATERIALS ASSOCIATIONS

I. MINIMUM SUBMISSION

A. 1. What would you consider to be the minimum documentation required for approval of housing by an evaluation agency?

- Conventional?
- Industrialized?

2. What documents and information would you prepare as a professional/manufacturer if there were no formal agency review, evaluation and approval of building systems?

3. Have you had any experience with such a condition (of no formal review, evaluation and approval)?

II. EXPERIENCE

A. 1. What has been your experience to-date with submissions to evaluate agencies?

- of conventional building?
- of industrialized housing?

2. Do you view such evaluation (for design approvals; not inspection for compliance) as a constraint to your design/construction process?

- in terms of time?
- in terms of money?
- in terms of manpower?

3. Do you employ special personnel to prepare submissions to evaluating agencies?

4. Does the documentation required by an evaluating agency serve any other function in your design/production process?

5. Are you involved with total design development of product?

B. What was your experience with the Operation Breakthrough evaluation process, in terms of all the points covered above?

NAME: _____

III. SPECIAL PROCUREMENT PROJECTS

A. 1. Have you had any experience as a designer/bidder on any building procurement project where a technical evaluation of the proposals was part of the bidding procedure?

- Federal government (DOD, GSA, etc.)?
- Local government or public agency?
- Private client?

2. Have you had any experience as a consultant to the owners of such building procurement projects?

3. Have you participated in the evaluation of proposals for any such building procurement projects?

B. Have you had any experience with the use of performance specifications in the procurement of buildings, building systems, or products?

- As writer of the specifications?
- As designer/manufacturer responding to specifications?
- As evaluator of responses to specifications?

NAME: _____

IV. INNOVATIONS

A. 1. Have you had experience with the industrialized housing process from prototype design to steady-state production?

2. What are your views on the current agency evaluation procedures with respect to the evaluation from prototype design to steady-state production?

3. Can you envision a system of prototype approvals which would not constrain the evaluation to steady-state production?

B. 1. Have you had any experience with the approval of products at a lower level of preassembly than complete 3-dimensional modules (e.g., subsystems, assemblies, components)?

2. Can you envision a uniform method of approval of products at all levels of preassembly so that subsystems could be approved both independently and as parts of larger systems?

V. COMPLIANCE

A. Have you submitted compliance assurance programs as part of product evaluation?

B. Have you developed a manual, guideline, or other information for the use of inspectors charged with the compliance assurance of your buildings?

C. 1. Have you administered compliance assurance programs for industrialized housing?

- Experiences:
- Recommendations:

2. Can you envision a uniform system of evaluation and compliance assurance for all types of industrialized housing systems?

3. Who monitors system?
   - Manufacturer?
   - Building official?
   - Third party?

4. Who pays for monitoring the system?

VI. CHANGES

A. Have you had any experience with developing and implementing changes in an approved building system?

B. 1. Do you view the current procedures of evaluation agencies as constraining the development and implementation of such changes?

2. Do you have any recommendations regarding procedures for review, evaluation and approval of changes in approved building systems?

Appendix G

GLOSSARY OF TERMS

For the purpose of this report, the listed terms are defined as follows:

Administrative Agency is a generic name for the state agency charged with administering the State's Manufactured Building Act.

Agency signifies the accredited or approved status of an institution to act as designee agent of the State Administrative Agency in the regulation of manufactured building. (e.g., Analysis Agency performs the Analysis Function.)

Analysis is the building-evaluation process which includes analytical examination and review of design and test documents using professional judgment and experience, to determine whether a proposed manufactured building or component conforms to applicable codes and standards.

Architect is one who has general knowledge of the basic principles, theories and practices in the field of architecture such as may be acquired through completion of a full architectural curriculum leading to a bachelor's degree from an accredited college or university, or through training equivalent in type, scope and thoroughness.

Building-Evaluation Agencies is a collective term for the group of agencies accredited to perform one or more of the building-

evaluation services of Analysis, Testing and Compliance Assurance.

Compliance Assurance is the building-evaluation process of appraising the manufacturer's compliance control program in conjunction with full-time or periodic monitoring, surveillance or audit, implemented to provide objective evidence that manufactured buildings or components conform to the approved documents.

Compliance Control Program is the manufacturer's system, including directly related quality and process controls, for assuring compliance with applicable codes and standards.

Criteria are standards or limits establishing the minimum satisfactory embodiment of equirements.

Engineer is one who has general knowledge of the basic principles, theories and practices in a given field of engineering such as may be acquired through completion of a full engineering curriculum leading to a bachelor's degree from an accredited college or university, or through training equivalent in type, scope and thoroughness.

Engineering Technician is one who has knowledge of the basic principles, theories, and practices in a given field of engineering such as may be acquired through the completion of at least two years of engineering curriculum at an accredited engineering college or university, or has graduated from a specialized technical vocational institute appropriate to his field, or through training equivalent in type, scope and thoroughness.

Institution is any candidate organization, government or private, profitmaking or not-for-profit, applying for accreditation to provide any one or all of the building-evaluation services of Analysis, Testing, and Compliance Assurance.

Manufactured Building Act refers to the Model Manufactured Building Act developed by Department of Commerce Special Working Group No. 1, or to any such equivalent Act as may be adopted by the State.

Methodology is the body of procedures for the examining agency to use in determining if the criteria for a building-evaluation function are met by an applicant institution.

Requirements are the attributes such as knowledge, skill or judgment needed to perform a task.

Task is the procedure or element of a particular building-evaluation function; often implied by the related requirement and thus unstated.

Testing is the building-evaluation process whereby the engineering properties claimed for manufactured buildings or components are validated by using appropriate standard test methods or other approved physical simulations based on recognized engineering principles.

CONTROL MATRIX

Attachment A

● MANDATORY SUBMISSION REQUIREMENTS

○ POSSIBLE SUBMISSION REQUIREMENTS DEPENDING ON CODE USED, OCCUPANCY, TYPE OF CONSTRUCTION, AND TYPE OF BUILDING SYSTEM

		SUBSTRUCTURE	SUPER-STRUCTURE: FLOOR COVERINGS	SUPER-STRUCTURE: ROOF COVERINGS	SUPER-STRUCTURE: JOIST AND RAFTER	SUPER-STRUCTURE: TRUSS	SUPER-STRUCTURE: COLUMN	SUPER-STRUCTURE: WALL LOAD-BEARING INTERIOR	SUPER-STRUCTURE: WALL LOAD-BEARING EXTERIOR	SUPER-STRUCTURE: WALL NON-LOAD-BEARING INTERIOR	SUPER-STRUCTURE: WALL NON-LOAD-BEARING EXTERIOR	SUPER-STRUCTURE: MISCELLANEOUS FRAMING, BRACING, LINTEL	SUPER-STRUCTURE: CONNECTIONS	SPACES AND ENCLOSURES: CORRIDORS AND PASSAGEWAYS PRIVATE	SPACES AND ENCLOSURES: CORRIDORS AND PASSAGEWAYS PUBLIC	SPACES AND ENCLOSURES: STAIRS AND RAMPS PRIVATE	SPACES AND ENCLOSURES: STAIRS AND RAMPS PUBLIC	SPACES AND ENCLOSURES: EXITS	SPACES AND ENCLOSURES: DOORS INTERIOR WITHIN LIV. UNIT	SPACES AND ENCLOSURES: DOORS INTERIOR TO PUBLIC SPACE	SPACES AND ENCLOSURES: DOORS EXTERIOR	SPACES AND ENCLOSURES: WINDOWS TYPICAL	SPACES AND ENCLOSURES: WINDOWS IN FIRE WALL	SPACES AND ENCLOSURES: SHAFTS ELEVATOR	SPACES AND ENCLOSURES: SHAFTS OTHERS	SPACES AND ENCLOSURES: BALCONIES	SPACES AND ENCLOSURES: SPECIAL SPACES, GARAGES, SHOPS	FINISH: INTERIOR	FINISH: EXTERIOR	MECHANICAL, PLUMBING, ELECTRICAL: BATH, SHOWER AND SINK	TOILET	HEATER	AIR CONDITIONER	VENTILATOR	STOVE	OVEN	WASHER	DRYER	LAMPS AND LUMINAIRES	OTHER APPLIANCES: ELECTRICAL	OTHER APPLIANCES: GAS	OTHER APPLIANCES: WATER	ELEVATORS AND DUMBWAITERS	DISTRIBUTION AND ACCESSORIES: WATER	DISTRIBUTION AND ACCESSORIES: GAS	DISTRIBUTION AND ACCESSORIES: ELECTRICITY	DISTRIBUTION AND ACCESSORIES: AIR	WASTE: LIQUID	WASTE: SOLID
GENERAL (ALL DISCIPLINES)	DIMENSIONS																																																
	LOCATION																																																
	WEIGHT																																																
DRAWINGS (ALL DISCIPLINES)	PLANS																																																
	CROSS SECTIONS																																																
	ELEVATIONS																																																
	DETAILS																																																
	LINE DIAGRAMS																																																
	ISOMETRICS																																																
STRUCTURAL ENGINEERING	STRUCTURAL CALCULATIONS AND DIAGRAMS																																																
	BEARING VALUES																																																
	LOADING SCHEDULES																																																
MECHANICAL, ELECTRICAL ENGINEERING AND PLUMBING	HEAT LOSS CALCULATIONS																																																
	MANUFACTURERS NAME, MAKE, MODEL																																																
	CLEARANCE FROM COMBUSTIBLE MAT'LS.																																																
	CLEARANCE FROM AIR INTAKES, FLUES, ETC.																																																
	CLEARANCE ABOVE GROUND OR OTHER STR'S																																																
	AIR SUPPLY AND RETURN																																																
	INPUT AND OUTPUT RATINGS																																																
	CAPACITY																																																
	PROVISION FOR GROUNDING																																																
	VENTILATION																																																
FIRE SAFETY	FIRE SEPARATION RATING																																																
	FIRE RESISTANCE RATING																																																
	FLAME SPREAD AND TOXICITY RATING																																																
MISC. (ALL DISCIPLINES)	TEST REPORTS LISTING OR LABEL																																																
	EMERGENCY PROVISION																																																
	SAFETY PROVISION (OPERATING SAFETY)																																																
	STRUCTURAL SUPPORT PROVISION																																																
	INSTALLATION AND CONNECTION INSTRUCTIONS																																																
	DATA PLATE																																																

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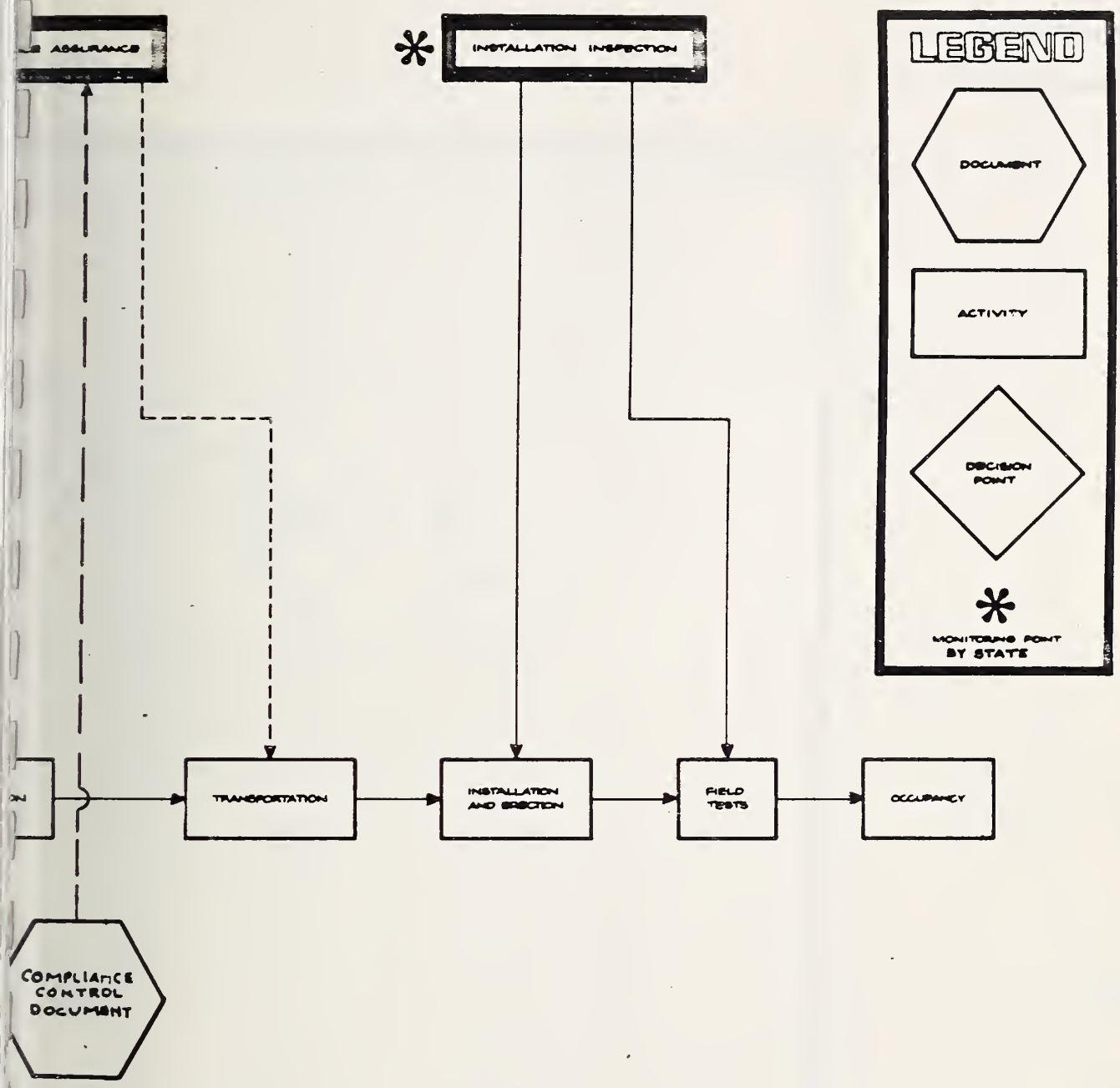
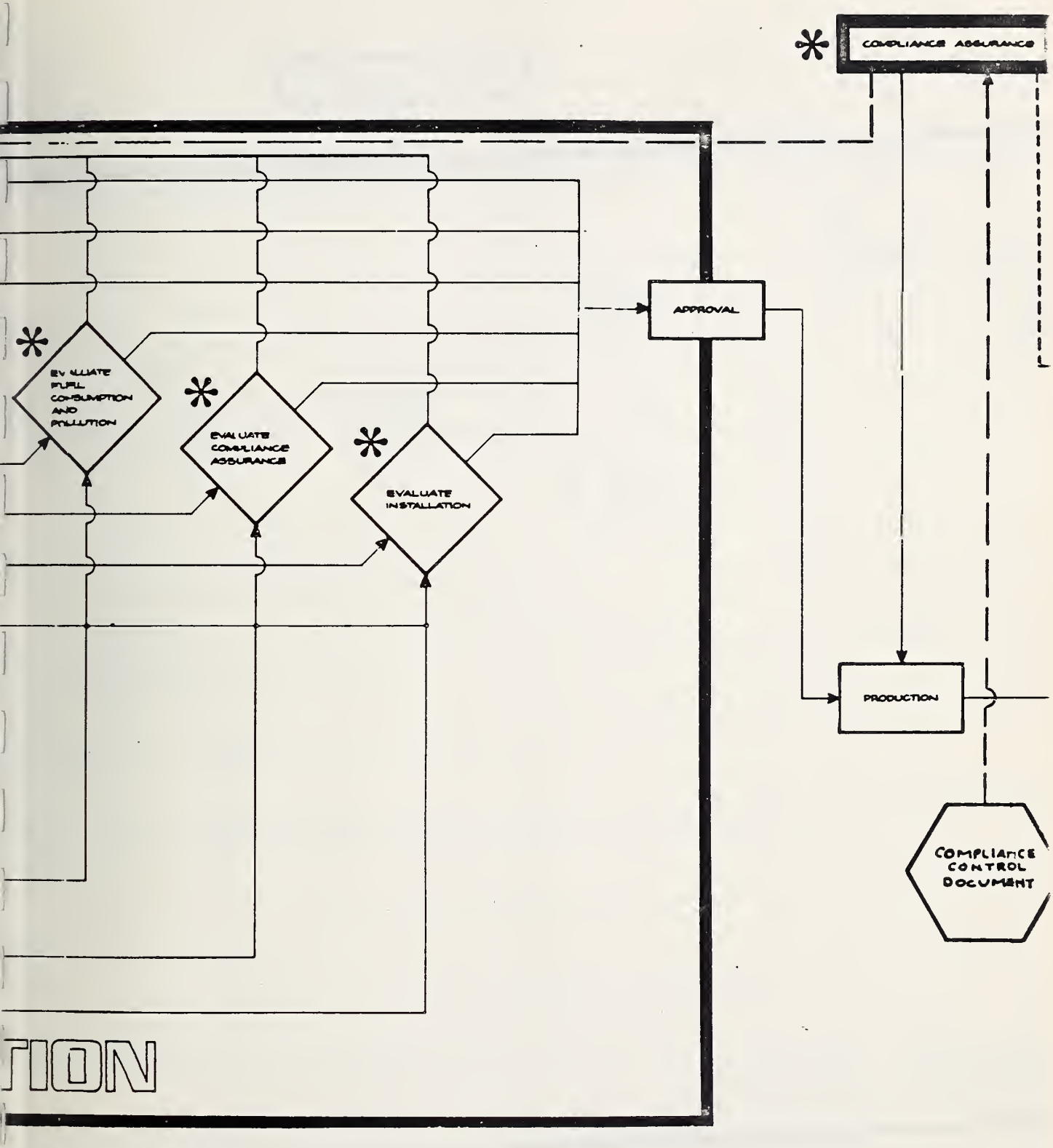
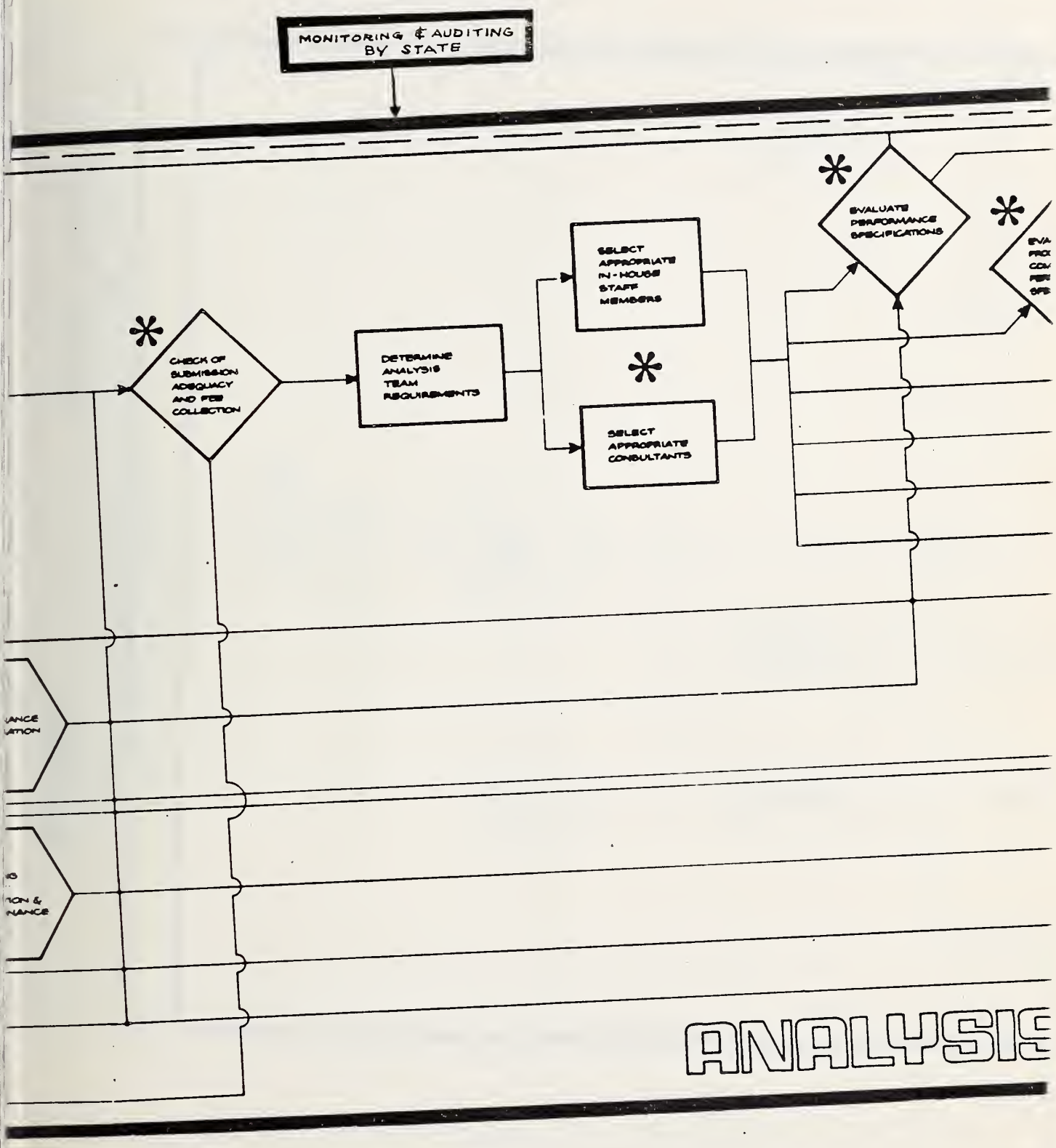
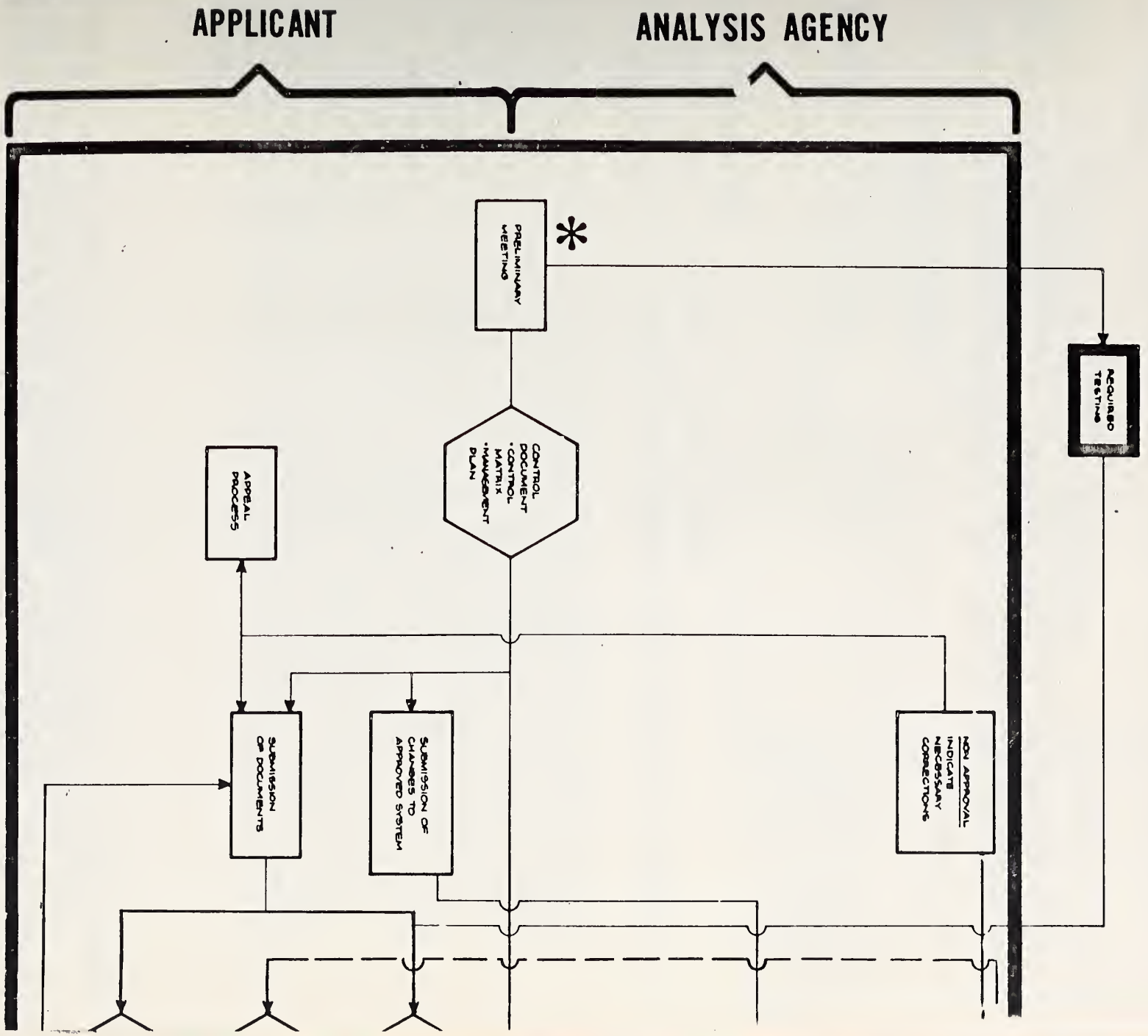


ATTACHMENT B


COMPLIANCE ASSURANCE
EVALUATE FUEL CONSUMPTION AND POLLUTION
EVALUATE COMPLIANCE ASSURANCE
EVALUATE INSTALLATION
APPROVAL
PRODUCTION
COMPLIANCE CONTROL DOCUMENT
TION


MONITORING & AUDITING BY STATE
CHECK OF SUBMISSION ADEQUACY AND FEE COLLECTION
DETERMINE ANALYSIS TEAM REQUIREMENTS
SELECT APPROPRIATE IN-HOUSE STAFF MEMBERS
SELECT APPROPRIATE CONSULTANTS
EVALUATE PERFORMANCE SPECIFICATIONS
ANALYSIS


APPLICANT
ANALYSIS AGENCY
PRELIMINARY MEETING
*
REQUIRED TESTING
CONTROL DOCUMENT
·CONTROL MATRIX
·MANAGEMENT PLAN
APPEAL PROCESS
SUBMISSION OF DOCUMENTS
SUBMISSION OF CHANGES TO APPROVED SYSTEM
NON APPROVAL
INDICATE NECESSARY CORRECTIONS

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Intend to submit to WERB after review by sponsor.

16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)

Criteria are proposed by which participating institutions may be judged for their capability to perform the Analysis function in the evaluation and regulation of manufactured one and two-family dwellings and components, including mobile homes. Procedures are also proposed for use by an examining agency in determining if the criteria are met. The criteria and methodology are intended as guidelines for objective examination of applicant public or private institutions who desire to serve as designees of state government in the analysis of documents describing a given manufactured building system or component. Based on a study of the state-of-the-art and current model enabling legislation, a comprehensive description of the required Analysis function services is provided as a basis for proposing a level of the criteria acceptable to the states. Appendices describe proposed institutional mechanisms and provide supporting information and forms. Implementation of the proposed criteria and methodology, through the standards making work of the ASTM E-32 committee, is intended to provide the states with a basis for informal reciprocity of institutional accreditations and of building-evaluation findings.

17. KEY WORDS (Alphabetical order, separated by semicolons) Accreditation; Agency; Approval; Analysis; Building; Building-Evaluation; Evaluate; Examine; Factory Built; Industrialized Building; Manufactured Building; Mobile; Modular; Plans; Specifications

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